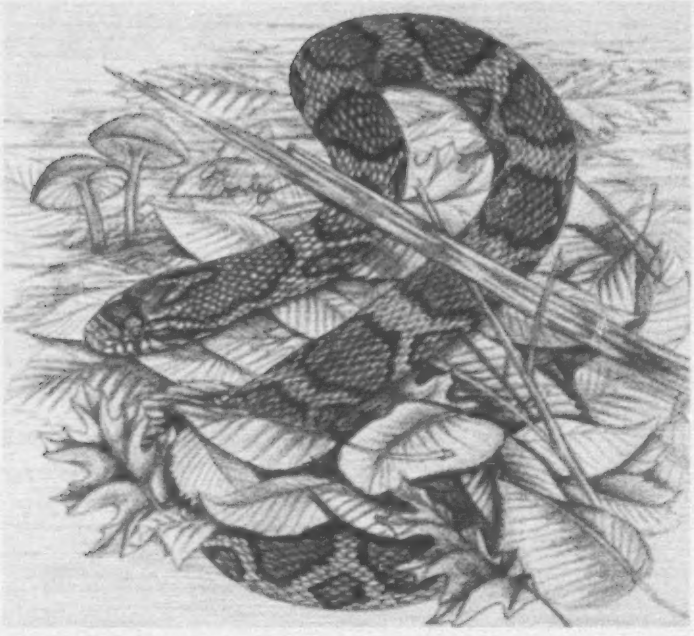
COSEWIC
Assessment and Status Report

on the

Eastern Milksnake
Lampropeltis triangulum

in Canada



SPECIAL CONCERN
2014

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

COSEWIC status reports are working documents used in assigning the status of wildlife species suspected of being at risk. This report may be cited as follows:

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COSEWIC would like to acknowledge Jonathan Choquette for writing the status report on the Eastern Milksnake (*Lampropeltis triangulum*) in Canada. This report was prepared under contract with Environment Canada and was overseen by Jim Bogart, Co-chair of the COSEWIC Amphibians and Reptiles Specialist Subcommittee.

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Eastern Milksnake — Sketch of the Eastern Milksnake (*Lampropeltis triangulum*). Illustration by Joe Crowley, used with permission.

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COSEWIC
Assessment Summary

Assessment Summary – May 2014

Common name
Eastern Milksnake

Scientific name
Lampropeltis triangulum

Status
Special Concern

Reason for designation
This large, non-venomous snake continues to be relatively widespread in southern Ontario and southwestern Quebec, but has suffered localized declines concurrent with expanding urbanization and intensification of agriculture. The life history characteristics of this species, including late maturation, longevity (up to 20 years), and relatively low reproductive potential, increase its vulnerability to various anthropogenic threats, including habitat loss, persecution and collection for the pet trade.

Occurrence
Ontario, Quebec

Status history
Designated Special Concern in May 2002. Status re-examined and confirmed in May 2014.

COSEWIC
Executive Summary

Eastern Milksnake
Lampropeltis triangulum

Wildlife Species Description and Significance

The Eastern Milksnake, *Lampropeltis triangulum* is tan, brown or grey and has large, black-outlined, red or brown dorsal blotches that fade as the snake ages. The maximum total length recorded for this species is 132 cm, although normal lengths range from 60-90 cm. The Eastern Milksnake is often found in barns and stables where it readily finds small mammals, its predominant prey.

Distribution

The global range of the Eastern Milksnake is confined to southeastern Canada and eastern U.S. In Canada, the Eastern Milksnake is mostly found in the Great Lakes / St. Lawrence and Carolinian regions within southern and central Ontario and southwestern Quebec. In Ontario, the Milksnake ranges from southwestern Ontario to Lake Nipissing, and in Quebec, the species occurs mostly within the Outaouais, Montérégie and Montréal regions. Although the species is widespread, there is evidence that Eastern Milksnake localities have been lost from large urban centres and regions with intensive agriculture.

Habitat

Eastern Milksnakes are habitat generalists but prefer open habitats, including rock outcrops and meadows. They require suitable microhabitats for egg laying, hibernation and thermoregulation. Eastern Milksnakes are well known for occupying barns, sheds and houses in rural landscapes. At the landscape scale, the abundance of Eastern Milksnakes appears to correlate with regions where forest cover is relatively high. Eastern Milksnake habitat in portions of southwestern Ontario and parts of southwestern Quebec (e.g. urban regions and areas subject to intensive agriculture) is fragmented and consists of relatively small, natural areas.

Biology

In Canada, Eastern Milksnakes emerge from hibernacula in early spring (April-May), when the mating season begins. Mating may last several weeks. In early summer, a clutch of approximately 10 eggs is laid in rotting logs, under boards, or in other substrate with suitable cover. Hatchlings emerge from August to September. When threatened, the Eastern Milksnake will often mimic a rattlesnake by vibrating its tail against the substrate or surrounding vegetation, but unlike rattlesnakes, Eastern Milksnakes are not venomous and are harmless to humans.

Population Sizes and Trends

Abundance estimates for the Eastern Milksnake at the national, provincial or regional levels are unavailable, but total adult population size is likely much greater than 10,000 adults. This species has been recently recorded in every Ontario jurisdiction (county or regional municipality) within their known range in that province. In Quebec, the Eastern Milksnake has recently been recorded in jurisdictions outside its previously documented provincial range.

Threats and Limiting Factors

Major threats to the persistence of the Eastern Milksnake in Canada are habitat loss from the expansion of urban and cultivated areas, road mortality, intentional killing, collection for the pet trade, and unnaturally high mortality from pets and other predators.

Protection, Status, and Ranks

In Canada, the Eastern Milksnake is considered a species of 'Special Concern' under the federal *Species at Risk Act* and under the Ontario *Endangered Species Act*. In Ontario, the Eastern Milksnake is listed as a 'specially protected reptile' under the *Fish and Wildlife Conservation Act*. In Quebec, the Eastern Milksnake is included on the *Liste des espèces susceptibles d'être désignées menacées ou vulnérables* (list of wildlife species likely to be designated threatened or vulnerable) and is offered protection under the *Loi sur la conservation et la mise en valeur de la faune* (act respecting the conservation and development of wildlife).

TECHNICAL SUMMARY

Lampropeltis triangulum

Eastern Milksnake — Couleuvre tachetée

Range of occurrence in Canada: Ontario and Quebec

Demographic Information

Generation time (see **Life Cycle and Reproduction**)	7-14 yr.
Is there an [observed, inferred or projected] continuing decline in number of mature individuals? Declines have been noted in localized areas and can be inferred from habitat trends.	Unknown
Estimated percent of continuing decline in total number of mature individuals within [5 years or 2 generations]	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over the last [10 years, or 3 generations].	Unknown
[Projected or suspected] percent [reduction or increase] in total number of mature individuals over the next [10 years, or 3 generations].	Unknown
[Observed, estimated, inferred, or suspected] percent [reduction or increase] in total number of mature individuals over any [10 years, or 3 generations] period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible and understood and ceased?	NA
Are there extreme fluctuations in number of mature individuals?	No

Extent and Occupancy Information

Estimated extent of occurrence (see **Extent of Occurrence and Area of Occupancy**)	229,285 km²
Index of area of occupancy (IAO)	1,452 km² (but see **Extent of Occurrence and Area of Occupancy**)
Is the total population severely fragmented? (see **Habitat Trends**)	No
Number of locations*	Unknown; >>>10
Is there an observed, inferred or projected continuing decline in extent of occurrence?	Unknown (but see **Extent of Occurrence and Area of Occupancy**)
Is there an observed, inferred or projected continuing decline in index of area of occupancy?	Unknown (but see **Extent of Occurrence and Area of Occupancy**)
Is there an observed, inferred, or projected continuing decline in number of populations?	Unknown

Is there an inferred continuing decline in number of locations* (see **Canadian Range** and **Fluctuations and Trends**)	Inferred decline based on absence of recent sightings from localities in southwestern Ontario, southwestern Quebec and from urban areas around Toronto and Montréal
Is there an observed or inferred continuing decline in area, extent and/or quality of habitat? (see **Habitat Trends** and **Fluctuations and Trends**)	Yes, in Toronto and Montréal and possibly in southwestern Ontario
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations*	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of Mature Individuals (in each population)

Population	N Mature Individuals
Total (see **Abundance**)	>10,000

Quantitative Analysis

Probability of extinction in the wild	Not done due to lack of data

Threats (actual or imminent, to populations or habitats)

- Housing and urban areas;
- Annual and perennial non-timber crops;
- Roads and railroads;
- Hunting and collecting of terrestrial animals; and
- Invasive non-native/alien species.

Rescue Effect (immigration from outside Canada)

Status of outside population(s)? Declining in northeastern U.S.	
Is immigration known or possible?	Possible
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Not in areas where a decline in the number of locations is inferred
Is rescue from outside populations likely? (see **Rescue Effect**)	Possible in southern Quebec

COSEWIC Status History

Designated Special Concern in May 2002. Status re-examined and confirmed in May 2014.

Status and Reasons for Designation

Status: Special Concern	**Alpha-numeric code:** Not applicable
Reasons for designation: This large, non-venomous snake continues to be relatively widespread in southern Ontario and southwestern Quebec, but has suffered localized declines concurrent with expanding urbanization and intensification of agriculture. The life history characteristics of this species, including late maturation, longevity (up to 20 years), and relatively low reproductive potential, increase its vulnerability to various anthropogenic threats, including habitat loss, persecution, and collection for the pet trade.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Not applicable
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable
Criterion C (Small and Declining Number of Mature Individuals): Not applicable
Criterion D (Very Small or Restricted Total Population): Not applicable
Criterion E (Quantitative Analysis): Not applicable

PREFACE

The Eastern Milksnake is currently listed under both Schedule 1 of the federal *Species at Risk Act* and Schedule 5 of the *Ontario Endangered Species Act* as a species of 'special concern'. To date (January 2014), neither a provincial nor a federal management plan for the species has been prepared.

As part of this status report update, a questionnaire was sent to 184 naturalists, herpetologists, resource managers, consultants and others in Ontario and Quebec who were presumed to have experience with, or possess knowledge of, Eastern Milksnakes in Canada (see **Appendix 1**). The questionnaire was sent by email in 2012 and five to six weeks were given to respond. A reminder email was sent. Completed questionnaires and/or species observations were received from 57 respondents (31% response rate), who collectively contributed almost 250 observation records. Questionnaire responses and supplementary observation records were used to support some of the conclusions presented in this report.

Since the previous status report, new research has been conducted on the dispersal, ecology, genetics, and physiology of the Eastern Milksnake. The species was elevated from a subspecies (*Lampropeltis t. triangulum*) to a species (*L. triangulum*) by Ruane *et al.* (2014). Ongoing field surveys and incidental observations, in concert with efforts by provincial databases, have resulted in an expansion of the known range of this species in Quebec. Conversely, these same efforts suggest that Eastern Milksnakes in certain portions of their Canadian range, namely southwestern Ontario and southwestern Quebec, are extremely rare or are absent from large portions of the landscape, and are possibly extirpated from some historical localities.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS
(2014)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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The Canadian Wildlife Service, Environment Canada, provides full administrative and financial support to the COSEWIC Secretariat.

COSEWIC Status Report

on the

Eastern Milksnake

Lampropeltis triangulum

in Canada

2014

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WILDLIFE SPECIES DESCRIPTION AND SIGNIFICANCE

Name and Classification

Common Name: Eastern Milksnake

French Name: Couleuvre tachetée

Class, Order, Suborder,
Family, Genus: Reptilia, Squamata, Serpentes, Colubridae, *Lampropeltis*

Species: *Lampropeltis triangulum* (LACÉPÈDE 1789), originally described as *Coluber triangulum*

The taxonomy of the genus *Lampropeltis* has recently undergone an extensive review (Ruane *et al.* 2014). Whereas *Lampropeltis triangulum* was previously described as a complex of multiple subspecies across North, Central and northern South America (Conant and Collins 1991; Crother 2012), it is now considered to consist of at least seven distinct species (Ruane *et al.* 2014). The Eastern Milksnake is the most northerly species and the only one found in Canada (Ruane *et al.* 2014). The previously recognized subspecies *L. t. triangulum, L. t. syspila* and *L. t. amaura* (in part) are now considered synonymous with *L. triangulum* (Ruane *et al.* 2014).

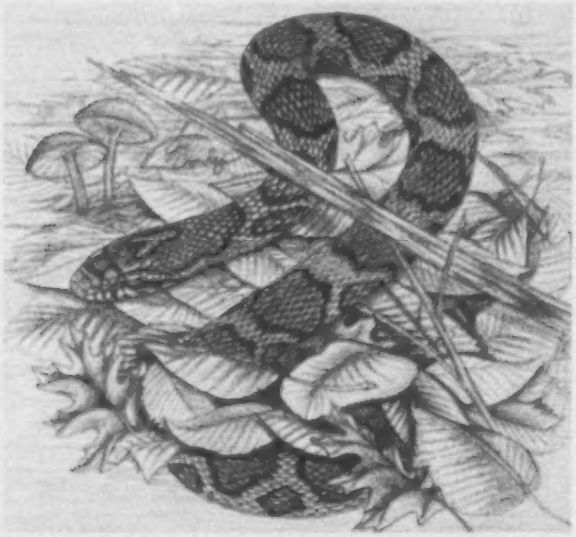

Figure 1. Sketch of the Eastern Milksnake *Lampropeltis triangulum* showing the dark border around each blotch and the distinct 'Y' shape behind the head (Illustration by Joe Crowley, used with permission).

Morphological Description

A wide range of colour and pattern variations occur between the different species of milksnakes (Tyning 1990; Lamond 1994). These can be attributed to differences in prey, natural predators, habitat and climate across their range (Fitch and Fleet 1970). Mimicry of sympatric venomous snakes such as Coral Snakes and Pigmy Rattlesnakes has also been attributed to variation in colour pattern (see discussion in Schueler 1992). The sole Canadian species, the Eastern Milksnake is the least vividly coloured of all congeneric species, and is also relatively uniform in colouration across its range (Schueler 1992). This snake is tan, brown or grey with a row of large dorsal blotches running the length of its body accompanied by two rows of smaller, irregularly shaped lateral blotches (Williams 1994). The blotches are chocolate-brown or reddish-brown in adults and are outlined in black (Figure 1). Young snakes have bright red blotches which become dull and brownish as they age (Bider and Matte 1994) (Figure 2). Dorsal and lateral blotches do not extend to the belly of the snake (Cochran and Goin 1970). The ventral surface has a black rectangular checkerboard pattern, which is often irregular, on a grey, tan or even whitish background (Cook 1984; Conant and Collins 1991). Though infrequently observed, neonates with a pure white ventral surface have been encountered (Gillingwater unpub. data).

The genus name 'Lampropeltis' means "shiny shield" (Tyning 1990), referring to the glossy, smooth, unkeeled dorsal scales of milksnakes (Logier 1958). 'Triangulum' is derived from '*triangulus*', which is Latin for "having three angles" or "triangle". This refers to the characteristic 'Y' or 'V' shaped blotch that extends from the head onto the neck of the Eastern Milksnake (Figure 1; Mitchell 1994; Williams 1994). Eastern Milksnakes have a slender body, which is nearly the same thickness along its entire length (Froom 1972). The milksnake derived its common name from the erroneous misconception that it milks cows (Logier 1958).

North American milksnakes do not get as long as their neotropical counterparts (Behler 1979). The average total length (including tail) of an adult Eastern Milksnake is 60-90 cm (Strickland and Rutter 1992) although the maximum total length recorded is between 132 cm (Cook 1984) and 140 cm (Brooks pers. comm. 2002). Males tend to be longer than females (Tyning 1990; Row and Blouin-Demers 2006a) and have relatively longer tails (Dyrkacz 1977; Williams 1994). Males also tend to have a slight constriction close to the cloaca (Tyning 1990). Gravid females have a thicker body posteriorly, tapering at the anal plate (Harding 1997). The Eastern Milksnake has a single, undivided anal plate (Cook 1984) and mid-body scale rows range from 19 to 23 (Harding 1997).

In Canada, the Eastern Milksnake is often confused with other snakes. These include juvenile Gray Ratsnakes (*Pantherophis spiloides*), Eastern Hog-nosed Snakes (*Heterodon platirhinos),* watersnakes (*Nerodia* spp.), Eastern Foxsnakes (*Pantherophis gloydi*), Eastern Massasaugas (*Sistrurus catenatus)* and juvenile North American Racers (*Coluber constrictor)* (Schueler 1992; Harding 1997; Willson pers. comm. 2002; Yagi *et al.* 2009).

Figure 2. Juvenile Eastern Milksnakes have brighter, red blotches and a lighter background colour than adults (Picture taken on the Bruce Peninsula by John Reaume).

Population Spatial Structure and Variability

There is no information on the population spatial structure and variability of the Eastern Milksnake in Canada. In the U.S., the Eastern Milksnake intergrades with the Scarlet Kingsnake (*L. elapsoides*) in some states (New Jersey, North Carolina, Maryland, Virginia) (Williams 1988; Conant and Collins 1991) but not in others (Alabama, Georgia, Kentucky, Tennessee) (Williams 1982 *as* cited by Schueler 1992).

Designatable Units

Currently, there is no evidence for dividing the Canadian population into more than one designatable unit: 1) genetic distinctiveness of Canadian populations has not been assessed, 2) this species is continuously distributed across its Canadian range (except for an apparent 50-100 km range gap between snakes in southwestern Quebec and those in the rest of Canada, see **Canadian Range**), and 3) the Eastern Milksnake is distributed continuously across the boundary between the Carolinian and the Great Lakes/St. Lawrence Amphibian and Reptile Faunal Provinces (COSEWIC 2009; Ontario Nature 2013). Thus, a single designation appears sufficient to accurately portray the current status of this species in Canada.

Special Significance

Froom (1972) stated that "the milksnake is one of our most beneficial and beautiful snakes." Although the economic impact of the Eastern Milksnake has never been quantified, it is thought to be beneficial, particularly for farmers (McCauley 1945; Logier 1958; Froom 1972; Hunter *et al.* 1992). Eastern Milksnakes hunt around old buildings in search of mice, perhaps decreasing mouse populations in older homes and around farm buildings (Ditmars 1939). Eastern Milksnakes often take young mice from their nests within old foundations and walls (Lazell 1976). Unfortunately, Eastern Milksnakes are often killed out of fear and misunderstanding (see **Threats and Limiting Factors**).

DISTRIBUTION

Global Range

The Eastern Milksnake is found in southeastern Canada and the eastern U.S (Figure 3; Ruane *et al.* 2014). Its range extends as far north as southern Minnesota, northern Michigan, Central Ontario and southern Quebec to as far south as northern Georgia, Alabama and Mississippi (Ruane *et al.* 2014). It is found as far east as Maine and as far west as Iowa and Missouri (Ruane *et al.* 2014). In the northeastern United States, some populations of Eastern Milksnakes are presumed to be in decline (Klemens 1993 as cited by Kjoss and Litvaitis 2001a; Mitchell 1994). The size of the global range of the Eastern Milksnake has not been estimated (NatureServe 2012).

Figure 3. The approximate global distribution of the Eastern Milksnake (*Lampropeltis triangulum)* from Fischer (2002). See Ruane *et al*. (2014) for approximate distributions of all seven species of *Lampropeltis*.

Canadian Range

In Canada, Eastern Milksnakes occur only in Ontario and Quebec and exist predominantly within two distinct Amphibian and Reptile Faunal Provinces: the Carolinian and the Great Lakes/St. Lawrence (note: there is a slight overlap between the range of the Eastern Milksnake and the Canadian Shield Faunal Province; COSEWIC 2009). The proportion of the global range of this species occurring in Canada is unknown, but appears to be at least 10% (see Figure 3).

The Eastern Milksnake ranges across southern and central Ontario, the southern portion of northern Ontario and southwestern Quebec (Figure 4). It is found as far north as Lake Nipissing in Ontario and its northern range limit closely follows 46° 30' N latitude (Schueler 1992). Historical occurrence in northwestern Ontario (Sault Ste. Marie) and southwest Ontario (Amherstburg in Essex County) have not been recently substantiated. In Quebec, the Eastern Milksnake appears to be limited to the southwestern part of the province, which includes the following regions: Laurentides, Laval, Lanaudière, Montérégie, Montréal, and Outaouais (Figure 5). Two historical records from farther east; one from Yamaska in 1874, and the other from Québec City in 1958 (Froom 1972; Bider and Matte 1994) have been rejected as erroneous (Desroches 2003, 2007).

In Quebec, Eastern Milksnakes have been recently confirmed in jurisdictions (counties, regional municipalities or equivalent) where they have not previously been recorded, resulting in a better understanding of their known range in that province (CDPNQ, 2014) (Figure 5). Although our knowledge of the known range has improved, the species is apparently rare. Some regions have no recent records and some have no records in the last 10 years. In Ontario, Eastern Milksnakes are still present (observed within the last 20 years) in all jurisdictions within their known range (Figure 6).

The Eastern Milksnake may be naturally absent from some relatively large areas within its Canadian range: 1) the Algonquin Highlands, and 2) a north-south band from extreme eastern Ontario north through the Laurentides region of Quebec (Figure 4). Furthermore, Eastern Milksnakes appear to be highly localized in parts of southwestern Ontario (see **Abundance**) and the number of localities may be in decline in some regions (e.g., Essex County, Ontario and Metro Toronto). Eastern Milksnakes appear to be absent from the Algonquin Highlands of Central Ontario (Brooks *et al.* 2000): the absence of Eastern Milksnakes from this area is probably the result of its relatively cool climate. Eastern Milksnake distribution in Canada appears to be correlated with areas receiving a minimum of 2100-2300 crop heat units, and the Algonquin Highlands receive between 1800-2100 crop heat units (see Brooks (2007) for a discussion of heat units and reptile distributions in Ontario. See Agriculture and Agri-Food Canada (2012) for a map of heat units).

There is an apparent 50-100 km wide range gap in the Canadian distribution of the Eastern Milksnake. This pattern has emerged owing to a lack of Eastern Milksnake records from eastern Ontario (east of the Frontenac Axis: Stormont, Dundas and Glengarry County, Prescott and Russell County; and the eastern portion of Leeds and Grenville County) and the Laurentides region of Quebec (Figures 4 and 5). There are no historical or recent records from these areas in the Atlas des amphibiens et des reptiles du Quebec (AARQ), Canadian Museum of Nature (CMN), Centre de données sur le patrimoine naturel du Quebec (CDPNQ), Ontario Natural Heritage Information Centre (ONHIC) databases, or the Ontario Reptile and Amphibian Atlas (ORAA) range map (Figures 5, 6). This lack of records is continuous south of the U.S. border into the Appalachian Mountain region of New York (New York State Department of Environmental Conservation 2013). Furthermore, the absence of records from this region does not appear to be the result of a lack of search effort (see **Search Effort**). Some have speculated that the apparent range gap results from a lack of suitable hibernacula (Schueler and Cook pers. comm. 2012) or unfavourable climate (Pelletier pers. comm. 2013). This apparent gap in the Canadian distribution of the Eastern Milksnake would suggest that snakes from the Montérégie and Montréal regions are currently, and have been historically, isolated from those in the rest of Canada. Future investigations are needed to confirm this distributional pattern.

There is evidence to suggest that the number of Eastern Milksnake localities in Metro Toronto and in Essex County is in decline. In Toronto, Johnson (1982) considered Eastern Milksnakes to be locally common, but already in decline three decades ago. Based on an interpretation of his 1982 occurrence map, his extensive surveys identified approximately 10 -17 localities where Eastern Milksnakes were present, the majority of which were isolated by intensive development (Johnson 1982). Remnant populations were found in abandoned farms, areas where farms used to occur, river valleys and ravines. In 2002, Johnson considered all Toronto populations, except for the Rouge Valley population, to be either in decline or extirpated because of habitat alteration (Johnson pers. comm. 2002). In 2012, he considered Eastern Milksnakes to be highly localized and 'occasional' in the Greater Toronto Area and that they were still experiencing a continuing decline (Johnson pers. comm. 2012). A preliminary analysis based on occurrence records suggests that Eastern Milksnakes have been recently confirmed at only 5 – 10 localities in Toronto (Choquette unpub. data). Pending additional analysis and field surveys to support this estimate, roughly half of historical localities in Toronto may have been lost in the last 30 years.

In Essex County, five to seven historical localities are reported by the ONHIC. Two of these, Pelee Island and East Sister Island, are considered of questionable validity (King *et al.* 1997). In 1989, the Eastern Milksnake was considered 'rare' in Essex and "almost certainly surviving in very low numbers" (Oldham and Sutherland 1986). At that time the species was probably known from five to six localities: 1) Cedar Creek (Allen and Oldham 1989); 2) the Balkwill Woodlot (Allen and Oldham 1989); 3) near Amherstburg (which probably included two sites, Amherstburg Quarry and Holiday Beach Conservation Area: Allen and Oldham 1989); 4) Point Pelee National Park (Stewart and Ross 1977; Seburn and Seburn 2000; Hecnar and Hecnar 2004); and 5)

the Ojibway Prairie Complex (Pratt 2010). Within the last 20 years, however, only one Eastern Milksnake record was reported to the ONHIC from Essex County (Point Pelee National Park in 1996) and the validity of this record is in question for a couple of reasons. First, three authors have suggested the species was already depleted or extirpated from that locality years ago (Stewart and Ross 1977; Seburn and Seburn 2000; Hecnar and Hecnar 2004) and second, it is quite possible that the snake was a misidentified Eastern Foxsnake, which is a similar-looking species and commonly found at Point Pelee. Even when search effort is taken into account (see **Search Effort**), it seems reasonable to presume that the Eastern Milksnake has become extirpated from Essex County entirely or persists within as few as one or two of its historical localities. Pending additional field surveys to support this estimate, over half of historical localities in Essex County may have been lost in the last 25 years.

Extent of Occurrence and Area of Occupancy

The extent of occurrence (EO) and the index area of occupancy (IAO) of the Eastern Milksnake in Canada were both calculated using occurrence records from the previous 20 years (1992-2011). The EO is estimated at 229,285 km², based on a minimum convex polygon within Canada's extent of jurisdiction (Figure 4). This is smaller than the previous estimate of "~250,000 km²" (Fischer 2002); however, previous estimation methods were not reported. The bulk of this discrepancy (~20,000 km²) is presumed to be attributed to the use of different methods and not an actual decline in EO of that scale. Regardless, a small decline in EO may have occurred based on the apparent decline of Eastern Milksnakes from Essex County (see **Canadian Range**; **Search Effort**).

The index area of occupancy (IAO) of the Eastern Milksnake in Canada is 1452 km² based on 2 km x 2 km grid squares and recent observation records (discrete IAO: 363 grids in total). Given the lack of search effort in some areas and low detectability of this species (see **Search Effort; Sampling Effort and Methods**), the IAO is most likely a gross underestimate of the actual area occupied, probably by at least an order of magnitude.

Previously, the area of occupancy (AO, not IAO) was estimated at ~ 65,000 km² (Fischer 2002), but estimation methods were not reported. Also, the occupancy of the Eastern Milksnake in Ontario is tracked by Ontario Nature (2013) based on 10 x 10 km grid squares. In their database there are 291 atlas squares with recent records (1993-2012) (Patterson pers. comm. 2013). At this scale, the current area occupied by the Eastern Milksnake is 29,100 km² in Ontario. Also, the AO for the Eastern Ribbonsnake (*Thamnophis sauritus*), with a similar distribution in Ontario, was estimated at 45,000 km² (Smith 2002). Including the area occupied in Quebec, it seems reasonable to presume the area occupied by the Eastern Milksnake in Canada is close to 30,000 km². Currently, there are not enough data to determine trends in IAO or AO of this species in Canada.

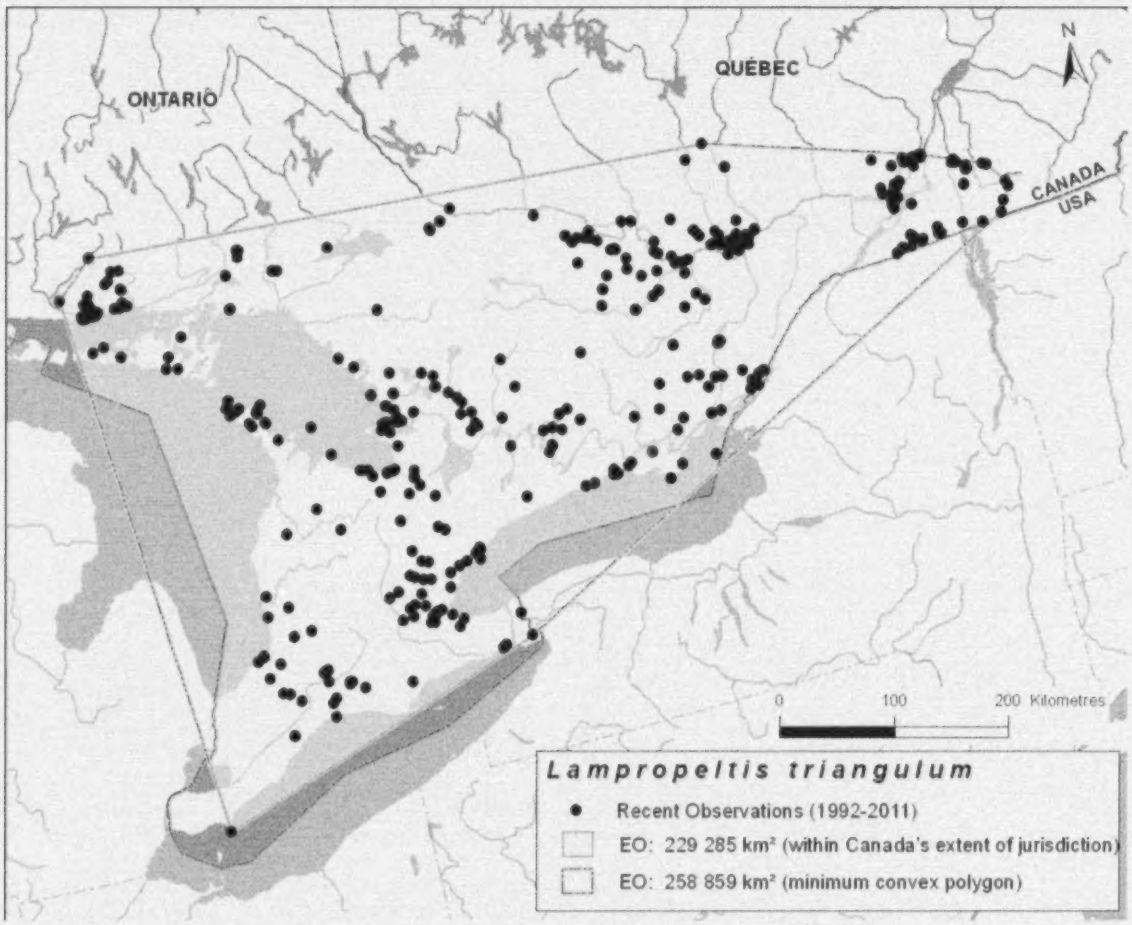

Figure 4. Canadian distribution (extent of occurrence) of the Eastern Milksnake. Image courtesy of Environment Canada (EC 2013).

Search Effort

Because of the low detectability of this species (see **Life Cycle and Reproduction; Sampling Effort and Methods**), caution must be exercised when making inferences about declines and absences from certain localities or regions. Furthermore, data held in provincial databases do not necessarily represent systematic inventories; therefore, the absence of recent records is not necessarily indicative of species absence or declines in areas where they had been historically documented (Oldham pers. comm. 2002). It is possible that either no significant search effort has been made in these areas, or that sightings have not been reported (Oldham pers. comm. 2002). Also, the frequency of observations often relates to accessibility rather than patterns of habitat use (Lindermeyer and Burgman 2005). That being said, we can be relatively confident in some of the distribution patterns and trends discussed in this section for the following reasons:

Canadian Distribution:

The Canadian distribution of the Eastern Milksnake is based largely on observations in provincial databases (AARQ, CDPNQ, CMN, ONHIC, ORAA, and Natural Resources and Values Information System [NRVIS]). Also, dozens of professionals were solicited for their non-submitted and most recent observations of this species through the 2012 Milksnake Questionnaire. Finally, extensive herpetofaunal sampling throughout the range of this species has occurred across Ontario and Quebec and has been facilitated through collection and processing of records by provincial databases since the mid-1980s (Figures 5, 6). Combined, these datasets represent hundreds of hours of herpetological search effort by a multitude of surveyors and hundreds of Eastern Milksnake observations (both intentional and incidental). Such sampling provides an accurate basis for the estimation of extent of occurrence (Gaston and Fuller 2009).

Eastern Ontario/Southwestern Quebec Range Gap:

Lack of search effort does not appear to be the best explanation for this apparent range gap. In extreme eastern Ontario, in addition to a lack of historical and contemporary records in provincial databases over the course of the last 30 years (Ontario Herpetofaunal Summary, ORAA activities), two prominent herpetologists have lived in the area for over three decades without having ever observed an Eastern Milksnake or having received reports of the species (Schueler and Cook pers. comms. 2012). In Quebec, although the Laurentides region has not been surveyed as extensively as the Gatineau area or the Metropolitan Montréal region, recent surveys in portions of that region were unsuccessful at finding Eastern Milksnakes despite five other snake species being observed (Desroches pers. comm. 2013). Also, over the course of the last 25 years (AARQ activities), if milksnakes were present it seems highly likely that even a few opportunistic records would exist for the region (Pelletier pers. comm. 2013). Finally, there are reports of other herpetofauna from both of the Ontario and Quebec regions in question in the ORAA and AARQ, so the lack of records is unlikely to be the result of a lack of accessibility or reporting in general.

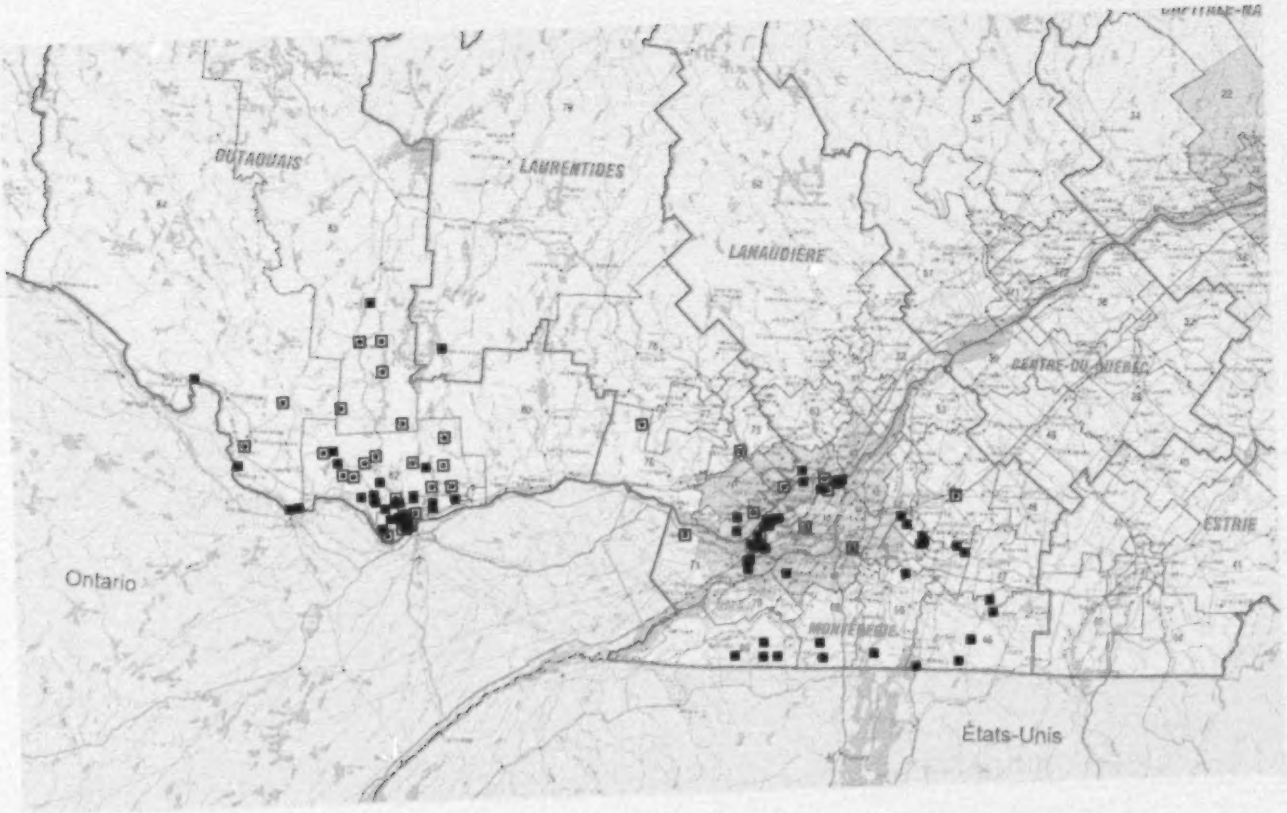

Figure 5. Eastern Milksnake observations in Quebec (CDPNQ 2014). Full black squares represent recent records (within the last 20 years), while squared dots represent historical records (>20 years old).

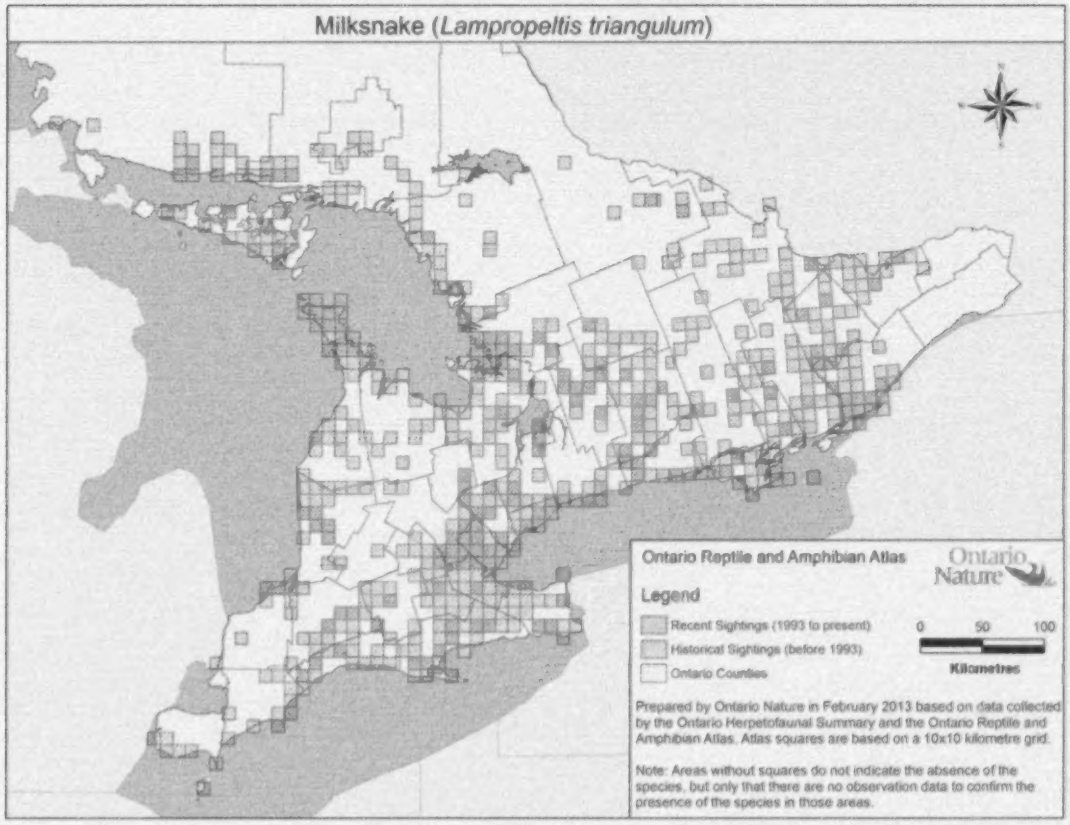
Milksnake (Lampropeltis triangulum)
Ontario Reptile and Amphibian Atlas
Ontario Nature
Legend
Recent Sightings (1993 to present)
Historical Sightings (before 1993)
Ontario Counties
0 50 100
Kilometres
Prepared by Ontario Nature in February 2013 based on data collected by the Ontario Herpetofaunal Summary and the Ontario Reptile and Amphibian Atlas. Atlas squares are based on a 10x10 kilometre grid.
Note: Areas without squares do not indicate the absence of the species, but only that there are no observation data to confirm the presence of the species in those areas.

Figure 6. Eastern Milksnake observations in Ontario as reported by the ORAA (Ontario Nature 2013).

Rarity in Extreme Southwestern Ontario:

In Essex County, recent searches or inventories conducted at the majority of historical Eastern Milksnake localities resulted in numerous reptile and amphibian sightings (but no Eastern Milksnakes were reported): 1)The Balkwill Woodlot was monitored yearly between 2007-2010 (CSLT 2011), 2) Near Amherstburg, intensive herpetofaunal surveys were conducted in 2010 by J. Choquette and others as part of a Big Creek Watershed Inventory, and 3) Point Pelee National Park receives a relatively large amount of search effort (incidental and intentional) by naturalists and professionals every year. In Essex County, the greatest number of reptile and amphibian records submitted to the ORAA in 2011 was from Point Pelee National Park (501 reptile and10,000 amphibian observations, Patterson pers. comm. 2012). Furthermore, no Eastern Milksnakes were observed in recent road mortality studies at Point Pelee National Park or the Ojibway Prairie Complex (see **Threats**). There is one historical locality in Essex County (Cedar Creek) which appears to be lacking recent search effort.

HABITAT

Habitat Requirements

The milksnakes are habitat generalists (Shaffer 1991). They can live in habitats that occur at sea level to elevations as high as 1430 m (Williams 1988). Eastern Milksnakes have been recorded in open habitats such as prairies, meadows and pastures, rock outcrops, and rocky hillsides (Tyning 1990; Conant and Collins 1991; Lamond 1994; Mitchell 1994; Jalava *et al.* 2005) as well as in forested habitats such as deciduous, coniferous, mixed forests and pine plantations (Tyning 1990; Mitchell 1994). In Ontario and Quebec, this snake is also found in utility corridors such as power-line cuts and railway embankments (Lamond 1994; G. Fortin and S. Giguère pers. comms. 2013). In a road mortality study by Tonge (2006), Eastern Milksnakes found dead-on-road (DOR) were found significantly closer to sparse forest habitat types than all other measured habitat types. Similarly, a recent radiotelemetry study of Eastern Milksnakes in eastern Ontario by Row and Blouin-Demers (2006a) suggests that Eastern Milksnakes preferentially use open and edge habitats (compared to closed-canopy habitats), regardless of the season, as these provide characteristics that aid in thermoregulation.

At the landscape scale, the Eastern Milksnake appears to be more common in areas in southern Ontario that are heavily forested. For example, western Milton, adjacent to Flamborough, and Halton Hills, as opposed to areas with a lower percentage of forest cover such as Brantford, Glanbrook, adjacent to Halton Hills, and eastern Milton. The Hamilton Herpetofaunal Atlas discerned this by comparing Eastern Milksnake distribution in southern Ontario to forest cover maps of that same area (Lamond 1994).

The Eastern Milksnake is best known from rural areas where it is most often reported in and around buildings such as barns, sheds and houses (Lamond 1994) and especially old structures (Williams 1988). It will enter foundations of these structures in search of food or shelter, and thus it is quite often reported in basements (Lamond 1994). Eastern Milksnakes are usually found close to a water source (Oldfield and Moriarty 1994) and under suitable cover objects including large planks, debris, stumps, decaying logs, rocks and rock piles, stones, bark, rubbish, tar paper, iron sheets, and damp trash (Shaffer 1991; Lamond 1994; Williams 1994). It is presumed that juveniles utilize the same habitat as adults because sightings of both juveniles and adults occur in the same areas (Lentini pers. comm. 2002). This snake has also been seen in suburban parks and gardens (Harding 1997). It is apparent that the Eastern Milksnake can live in almost any habitat that provides shelter and a source of food (Harding 1997).

With respect to special habitat requirements, the Eastern Milksnake needs suitable cover for egg-laying (DeGraaf and Rudis 1983) and hibernation. These snakes require hibernation sites that provide shelter from freezing temperatures and with enough moisture to prevent desiccation during winter (Lentini pers. comm. 2002). Suitable hibernation sites include mammal burrows, old building foundations (Lamond 1994),

crawl spaces (Harding 1997), old wells and cisterns, stone walls, gravel, clay and dirt banks, hollow logs, rotting stumps (Ernst and Barbour 1989) or rock crevices (Tyning 1990). The same sites may be used more than once (Ernst and Barbour 1989). There are many reports of Eastern Milksnakes in basements of older homes in highly populated areas (Johnson 1989) where hibernacula may be limited due to the destruction of habitat.

Eggs are laid in a variety of substrates including rotting logs (Strickland and Rutter 1992; Lamond 1994), stumps, mammal burrows (Ernst and Barbour 1989), piles of manure, leaf mounds (Froom 1972), sawdust piles (Lamond 1994), compost (Tyning 1990), sand, under boards, logs, or in loose soil (Williams 1988).

The home range size of milksnakes in the U.S. is 10 - 20 ha (Fitch and Fleet 1970; Kjoss and Litvaitis 2001a). In eastern Ontario, Row and Blouin-Demers (2006b) found the home range sizes of 10 male Eastern Milksnakes to range from 5 – 29 ha. Not surprisingly, a study by Kjoss and Litvaitis (2001a) found relatively greater abundance of milksnakes on large (>10 ha) as opposed to small (1.5-10 ha) habitat patches. There is no evidence that the Eastern Milksnake defends territories from conspecifics (Tyning 1990).

Habitat Trends

Coastal meadow marshes, bedrock shorelines, fresh to moist-fresh deciduous and mixed forests habitat types, all used by Eastern Milksnakes, have declined in area due to resource extraction and development (Jalava *et al.* 2005). Conversely, open, shrub and treed rock barrens in the eastern Georgian Bay coast, a preferred Eastern Milksnake habitat type (see **Habitat Requirements**), is largely intact, well represented in protected areas and probably more extensive today than historically (Jalava *et al.* 2005).

Eastern Milksnake habitat in portions of its range is probably characterized by small, isolated patches. In the 2012 Milksnake Questionnaire, 11 respondents (21%) were of the opinion that Eastern Milksnake populations appeared to be fragmented (i.e., isolated from one another). The majority of these respondents were referring to Eastern Milksnake populations in southwestern Ontario (or counties therein). Regardless, the Eastern Milksnake is not considered to be severely fragmented in Canada. COSEWIC (2012a) defines as taxon as being severely fragmented if "most (>50%) of its total area of occupancy is in habitat patches that are (1) smaller than would be required to support a viable population, and (2) separated from other habitat patches by a large distance." The minimum patch size for sustaining viability is unknown but likely much greater than 10 ha (see **Habitat Requirements**) and isolated patches are probably separated by at least 400m of unsuitable habitat (see **Dispersal and Migration**). Based on limited data, and in the absence of a detailed analysis, the latter conditions are probably confined to southwestern Ontario and southern Quebec, which appear to make up less than half of the area of occupancy of the Eastern Milksnake (Figures 4, 5, 6).

In Quebec, the range of the Eastern Milksnake overlaps the most populated region of the province. Habitat loss and fragmentation are extensive and ongoing as a result of urban development and intensive agriculture. In the Laval region, several patches of high quality habitat have been destroyed in recent years for residential or commercial development (Pelletier pers. comm. 2013). In Montréal, Eastern Milksnakes persist in small isolated urban parks (Desroches pers. comm. 2013). Recent construction work at two Montréal sites resulted in the removal of Milksnake habitat, prompting biologists to capture and relocate two Eastern Milksnakes (Giguère pers. comms. 2013). Also, in southern Quebec, Milksnake habitat is fragmented by intensive agriculture (Giguère pers. comms. 2013) and this species persists predominantly within protected areas (Desroches pers. comm. 2013).

In the northeastern U.S., early successional and shrub-dominated habitats are among the most rapidly declining ecological communities (Vickery *et al.* 1995; Litvaitis *et al.* 1999; both as cited by Kjoss and Litvaitis 2001a). In New Hampshire, the area of seedling/sapling-sized forest had declined from 344,000 ha in 1973 to ~159,000 ha in 1997 and large patches >10 ha are especially rare (Litvaitis and Villafuerte 1996; Litvaitis *et al.* 1997; both as cited by Kjoss and Litvaitis 2001a).

BIOLOGY

Life Cycle and Reproduction

Hibernation

Eastern Milksnakes are generally active from mid-April until October in Canada (Lamond 1994; Row and Blouin-Demers 2006a), after which they enter hibernation. Eastern Milksnakes often hibernate communally (Harding 1997) and sometimes with other species. For example, several Eastern Milksnakes were captured near Kingston, Ontario, from a network of fenced Gray Ratsnake hibernacula (Blouin-Demers pers. comm. 2013). Eastern Milksnakes will bask communally near the hibernaculum in spring and fall (Vogt 1981; Coffin and Pfannmuller 1988). They have also been observed basking at hibernacula with other species including Southern Copperheads (*Agkistrodon contortrix*), hog-nosed snakes (*Heterodon* spp.), North American Racers, rattlesnakes (Tyning 1990) and gartersnakes (Johnson 1989). In the spring, Eastern Milksnakes in northern areas, and those that live at higher elevations, may emerge from their den sites before other species of snakes (Tyning 1990).

Reproduction

Little is known about reproduction of the Eastern Milksnake (Mitchell 1994); however, its breeding habits are presumed to reflect those of typical oviparous (egg-laying) snakes. Two to three weeks after emerging from hibernation, the mating season begins and extends over several weeks, from mid-April to early June (Ernst and Barbour 1989; Lamond 1994). Communal egg laying sites have been observed in

Canada (AARQ 2012). The behavioural significance of this is unclear; however, it may occur where suitable egg-laying sites are limiting (Tyning 1990). Communal egg-laying behaviour has been observed in other Ontario snakes (Eastern Foxsnakes: Marks pers. comm. 2011; Gray Ratsnakes: Blouin-Demers *et al.* 2004; Eastern Hog-nosed Snakes: Robson 2011).

Gestation in the Eastern Milksnake is usually 30 to 40 days. Gravid females most likely stop eating a few weeks before oviposition to invest more energy in thermoregulation and finding a nesting site (Henderson *et al.* 1980). Although the female does not build a nest, there are indications that she creates a small chamber within which eggs are deposited (Tyning 1990). The deposition of most eggs occurs from late May to July (Ernst and Barbour 1989). Eggs are elliptical (Shaffer 1991), smooth, tough, opaque, and leathery-white and may, but not always, adhere to one another in a cluster (Williams 1988). The eggs are 21-35 mm in length, 11-15 mm wide and each egg weighs approximately 4.5 g (Ernst and Barbour 1989). The number of eggs laid is positively correlated with body length of the female (Ernst and Barbour 1989). For example, the Western Milksnake (*L. gentilis*) that have been recorded to reach total lengths up to 92 cm (Fitch and Fleet 1970) lay only 4-9 eggs (Ernst and Barbour 1989), whereas female Eastern Milksnakes, which attain greater lengths, lay 8-11 eggs (Fitch and Fleet 1970).

Eastern Milksnakes are presumed to lay a single clutch of eggs per year in Canada, although two clutches per year might be possible (Tryon 1984, as cited by Ernst and Barbour 1989). It is unknown if annual or biennial reproduction occurs (Tyning 1990). Incubation of the eggs takes 50 to 70 days (Ernst and Barbour 1989) at a constant temperature of approximately 24°C (Williams 1988). Hatching normally occurs in August or September (Ernst and Barbour 1989), but may occur as early as July in southern Ontario (Lamond 1994). Hatchlings range from 162-241 mm in total length (Williams 1988).

Growth and Survivorship

As with most snakes, little is known about the life of young milksnakes (Tyning 1990). Depending on when young hatch, they may not feed before their first winter and as a result would only grow minimally, and may even lose weight before hibernation (Fitch and Fleet 1970).

According to Fitch and Fleet (1970), who studied milksnakes in Northeastern Kansas, hatchlings grow an average of about 15% over their original length (or 30 mm) within the first two months of their active life. These first-year snakes are fairly recognizable from other age classes as they make up a distinct size class, ranging from 198-268 mm (mean = 237 mm) snout-vent length (SVL). Second-year snakes are thought to attain 296-397 mm (mean = 360 mm) SVL. Although some overlap likely occurs between 2nd and 3rd year individuals, 400 mm SVL can be used as a boundary to separate these two age groups. Third-year snakes range from 400 to 500 mm SVL and rapid growth continues on into the 4th and 5th years (Fitch and Fleet 1970). Sexual maturity is reached at 3 to 4 years of age (Fitch and Fleet 1970; DeGraaf and Rudis 1983).

Milksnakes may live more than 20 years. The longest living Eastern Milksnake recorded was a female that was caught as an adult and lived an additional 21 years at the Philadelphia zoo (Ernst and Barbour 1989). A long life expectancy suggests that high adult survivorship is critical to population persistence (Brooks pers. comm. 2002).

Generation time, the average age of parents of the current cohort, is estimated as follows: Generation Time = age at which 50% of total reproduction is achieved. If we assume female reproduction is every year, age of maturity is 3-4 years and maximum breeding age is on average 10 years (Applegate Reptiles 2012, BGSU HL 2012) then an average female has 6 - 7 breeding years. A female would achieve 50% of her reproductive output after 3 - 3.5 years of breeding, or at 6 - 7.5 years of age. Generation time is estimated to be at least 7 years. However, given that maximum age in captivity is at least 25 years, it is possible that maximum breeding age is closer to 20 years and generation time closer to 13-14 years.

Behaviour

Eastern Milksnakes are considered a cryptic, fossorial species (Lazell 1976; Williams 1982 as cited by Schueler 1992; Scheffers *et al.* 2009), are secretive and hunt at night (Harding 1997), so they are rarely observed (Vogt 1981) and usually never seen in large numbers (Schueler 1992). Secretive species are difficult to detect and may or may not be locally abundant (see **Sampling Effort and Methods**).

There are certain behavioural characteristics of the Eastern Milksnake, which render it vulnerable to persecution. For example, when disturbed or threatened it takes on a defensive pose, raises its head in the air, vibrates its tail and attempts to bite (Green and Pauley 1987). When picked up, it often bites with a persistent "chewing" motion or hangs on so that it is difficult to remove. If the vibrating tail hits dry leaves or a similar substrate, the sound produced resembles that made by a rattlesnake. This sort of behaviour is thought to protect milksnakes from potential predators (Tyning 1990; Lamond 1994). There have been a number of reports in Canada of "rattlesnakes" which turned out to be Eastern Milksnakes (Johnson 1989; Scallen pers. comm. 2002).

Physiology and Adaptability

Although milksnakes bask in the open, they do not do so as often as other snake species (Tyning 1990). Milksnakes usually thermoregulate by obtaining heat from the underside of an object in direct sunlight (Ernst and Barbour 1989). The snake will absorb heat from objects such as leaves (Tyning 1990), boards (Willliams 1994), metal sheets (Henderson *et al.* 1980) and other suitable cover. Body temperatures were recorded by Henderson *et al.* (1980) in a range between 13° C and 30° C. As snakes need to raise their body temperatures to digest food or to advance development of their eggs, basking under objects allows them to do so at a decreased risk of predation (Henderson *et al.* 1980). Thermoregulation is especially important for gravid females that have to maintain a higher, more stable body temperature than non-gravid females to attain proper egg development. In addition, Eastern Milksnakes prefer sites close to large rocks and boulders which serve as retreats for cooling and for protection from predators (Row and Blouin-Demers 2006a). Eastern Milksnakes thermoregulated more effectively and frequently in spring than in any other season (Row and Blouin-Demers 2006a). The preference for open habitats by this species (see **Habitat Requirements**) is driven by the need to effectively thermoregulate.

The northern distribution of Eastern Milksnakes is probably not limited by prey availability (Bleakney 1958) and is more likely constrained by climate (Brooks *et al.* 2000). The range of this species in Canada appears restricted to areas receiving a minimum of 2100-2300 crop heat units (see **Canadian Distribution**).

Dispersal and Migration

Like many other snakes, milksnakes conduct seasonal movements to and from hibernacula. In spring and fall, for example, milksnakes are found farther upland than they are in midsummer, probably because they are closer to their hibernation sites during those times (Ernst and Barbour 1989). The snakes may migrate to lowland areas in summer in search of food and moisture (Breckenridge 1958; as cited by Williams 1988). Fitch and Fleet (1970) studied movements of milksnakes in northeastern Kansas and the mean distance travelled by six individuals over several months was 260 m (76 to 396 m). In eastern Ontario, Row and Blouin-Demers (2006a) found that radio-tracked Eastern Milksnakes moved more in summer than any other season. They also observed the snakes basking/resting mostly in the spring and were concealed mostly in the summer and fall.

Interspecific Interactions

The Eastern Milksnake is restricted to relatively small prey (Tyning 1990) because of its small, delicate jaw and slim body (Fitch and Fleet 1970). Eastern Milksnakes bite their prey and wrap several coils around the animal squeezing tighter and tighter until the animal suffocates (Vogt 1981) or possibly suffers a heart attack. This is advantageous because the snake can swallow the animal whole without being bitten (Vogt 1981). Small prey, such as baby mice and eggs, are swallowed without

constriction (Harding 1997). Young Eastern Milksnakes eat earthworms (MacCulloch pers. comm. 2002) and the young of other snake species including Ring-necked Snakes (*Diadophis punctatus*), Garter Snakes (*Thamnophis* spp.), Green Snakes (*Opheodrys vernalis*), Dekay's Brownsnakes (*Storeria Dekayi*) and Red-bellied Snakes (*Storeria occipitomaculata*) (Vogt 1981). The Eastern Milksnake has a high level of immunity against the venom of Southern Copperheads and Timber Rattlesnakes (*Crotalus horridus*) and milksnakes will eat individuals of these species (Logier 1958).

Adult Eastern Milksnakes eat rodents, reptiles, fish, and amphibians as well as a number of different invertebrates (Bider and Matte 1994; Lentini pers. comm. 2002). Brown (1979; as cited by Ernst and Barbour 1989) determined that mammals comprise 68% of all the food items and 79% of the food volume in those wild snakes he examined. He also stated that young mammals comprised 59% of all mammals taken, birds made up 12.7% of food volume with a frequency of 19%, and reptiles comprised 8.1% of food volume with a frequency of 12.4%. Surface (1906; as cited by Williams 1988) found that, in Pennsylvanian specimens, mice comprised 71.5% of the stomach contents (by volume), other mammals made up 11.0%, birds 5.5% and slugs 3.0%. The milksnake's preference for small mammals would account for the snake's occurrence in and around barns where mice and rats are common (Lamond 1994). In eastern Ontario, scats of adult Eastern Milksnakes consisted almost entirely of mammal hair (Row and Blouin-Demers 2006a).

Predators of Eastern Milksnakes include Bullfrogs (*Lithobates catesbeiana*), Brown Thrashers (*Toxostoma rufum*) (Mitchell 1994), hawks, owls, Raccoons (*Procyon lotor*), Coyotes (*Canis latrans*), foxes, skunks, Virginia Opossums (*Didelphis virginiana*) (Ernst and Barbour 1989), other snake species (Hunter *et al.* 1992) and the Eastern Milksnake itself (Ernst and Barbour 1989). Weasels and shrews, which hunt underground for food, may consume eggs and young hibernating Eastern Milksnakes (Harding 1997). Furthermore, natural snake predators such as Raccoons, Opossums, foxes, Coyotes and skunks may also have negative impacts on Eastern Milksnake populations in agricultural or urban landscapes where these predators have been 'subsidized' (i.e., when human-altered resource availability artificially increases population densities).

POPULATION SIZES AND TRENDS

Sampling Effort and Methods

Eastern Milksnake abundance is difficult to estimate because of the secretive nature of this species and, as a consequence, its low probability of detection. For example, the majority of observations in the ONHIC and AARQ are of single individuals. A low detection rate, however, does not necessarily correlate with low abundance, particularly when employing count-based indices (Durso *et al.* 2011). In a study comparing detectability and density estimates of multiple watersnakes in South Carolina, a positive correlation between density and detectability was found for some species; whereas for others it was unclear whether low detectability resulted from

relatively lower densities of these species or a poor ability to capture them with the methods used (Durso *et al.* 2011). The low detectability of the Eastern Milksnake, however, is probably because they occur at relatively low densities across much of their North American distribution. A comparison of multiple snake studies employing a range of methods (different types of cover objects, drift fences, opportunistic surveys and road mortality surveys) suggests that regardless of survey type, milksnake observations tend to make up an extremely small proportion of all snakes observed (**Appendix 2**, **Appendix 4**).

Such low capture and recapture rates hinder estimates of population size. Fitch and Fleet (1970) recaptured only 11 of 58 marked milksnakes in their 22-year study and capture rates in any given year were too low to allow for population size estimation. Not surprisingly, no formal population size estimates have been conducted for Eastern Milksnakes at the local or provincial level in Canada (Quebec: MDDEFPQ 2009).

Abundance

An accurate estimate of the total adult population size of the Eastern Milksnake in Canada is not available. In the 2002 COSEWIC status report, population size was estimated for Quebec (3000-5000 adults; estimation method unknown) but not for Ontario (Fischer 2002). Regardless, a crude 'order of magnitude' estimate can be obtained by multiplying estimated densities of Eastern Milksnakes by the estimated area of occupancy.

Field surveys for Eastern Milksnakes at a few Canadian localities have provided preliminary information on capture rates and population densities:

- at Grand-Bois-Saint-Grégoire, in Mont-Saint-Grégoire, QC, over the course of a four-year mark-recapture study using cover boards, 10 Eastern Milksnakes were observed (Fortin and Giguère pers. comms. 2013). This equates to ~ 0.02 snakes captured per hectare (10 snakes / 467 ha).
- at the Queen's University Biological Station, north of Kingston, Ontario, 76 individual Eastern Milksnakes were captured over a 3-year study (Row pers. comm. 2012), employing hibernacula fencing, among other capture methods. This equates to ~ 0.03 snakes captured per hectare (76 snakes / 3000 ha).
- at two sites in the Montréal, QC, region (L'Île Bizard and Rivière-des-Prairies), 31 Eastern Milksnakes were observed across both sites during four years of hibernacula surveys (3-10 days of total surveying per site) (Fortin and Giguère pers. comms. 2013). This equates to ~ 0.06 snakes captured per hectare (31 snakes / 477 ha).
- at Rouge Park in Toronto, Ontario, 11 Eastern Milksnakes were encountered over a 5-month (May-October) study employing 100 cover-boards (Lentini *et al.* 2011). This equates to ~ 0.07 snakes captured per hectare (11 snakes / 153 ha).

- at Parc de la Gatineau, in Gatineau, QC, over the course of a two-year summer study employing over 100 cover boards spread across a one hectare site, 2 - 6 individuals were observed in a season (AARQ 2012). This equates to ~ 4 snakes captured per hectare, on average.

Capture rates do not reflect actual population densities as abundance estimates were not conducted in any of the studies. This comparison does suggest, however, that capture rates are generally low and that population densities in Canada are at least 2 - 7 snakes per km². In addition, based on a review of COSEWIC status reports for five other snake species in Ontario (Wilson and Rouse 2002; COSEWIC 2006; 2007a; 2007b; 2012b), estimated snake densities (# mature individuals / [IAO or AO]) average 20 (4 – 69) mature individuals per km². Using these estimates and an AO of ~30,000 km² (see **Extent of Occurrence and Area of Occupancy**), the total adult population size of the Eastern Milksnake in Canada could be in the high tens of thousands, if not hundreds of thousands, of mature individuals. This is clearly a crude estimate, but does provide an indication that the population is likely much larger than 10,000 mature individuals.

Relative abundance of Eastern Milksnakes probably varies across its Canadian range. Respondents to the 2012 Milksnake Questionnaire were asked to rank the relative abundance of Eastern Milksnakes in one or more regions based on their professional experience with the species. Abundance categories were: 'rare', 'occasional', 'frequent', 'common' and 'abundant'. Of 132 responses (multiple responses were allowed per respondent) covering 43 jurisdictions in Ontario and Quebec, the most common response was that Eastern Milksnakes were either 'occasional' or 'frequent' (95/132 = 72%) within any particular jurisdiction. The following jurisdictions received the highest number of responses: Bruce (n=9), Simcoe, (n=7), Muskoka (n=7), Parry Sound (n=7), Niagara (n=6), Wellington (n=5), Toronto (n=4), Peterborough (n=4), Manitoulin (n=4), Leeds and Grenville (n=4), and Grey (n=4). The most common opinion for each of these regions was that Eastern Milksnakes are 'occasional'. The exception was Peterborough, where the popular opinion was that Eastern Milksnakes were 'common'. Across all jurisdictions, at least one respondent suggested that Eastern Milksnakes were 'common' or 'abundant' in the following: Brant, Bruce (n=2), Kawartha Lakes, Leeds and Grenville, Manitoulin, Muskoka (n=2), Niagara, Northumberland, Parry Sound, Peterborough (n=2), and Waterloo.

In extreme southwestern Ontario, Eastern Milksnakes appear to be relatively rare. In the 2012 Milksnake Questionnaire, respondents suggested that Eastern Milksnakes appeared absent or rare in many counties (Table 1). Specifically, respondents were unanimous in the opinion that Eastern Milksnakes were 'rare' in Chatham-Kent (n=2), Essex (n=3), and Lambton (n=2) counties (Table 1). Also, Chatham-Kent, Essex, Brant, Oxford and Perth have very few observation records within the last 20 years (Table 1).

Table 1. Southern Ontario counties where the Eastern Milksnake may be absent or extremely rare based upon professional opinions and records in provincial databases. Q11 and Q12 are two questions posed to ecologists, resources managers and naturalists through the 2012 Milksnake Questionnaire regarding the status of the Eastern Milksnake in Canada. The number of respondents who answered with relation to a particular region is indicated by 'n'. Records were assembled from the CMN, ONHIC and from various professionals.

Ontario County	Q11. are you aware of any extensive areas or portions of regions where [Milksnakes] appear to be absent?	Q12. how would you rate [the] apparent abundance [of the Milksnake] (on average) relative to other snake species? (Rare, occasional, frequent, common or abundant?)	20-year records (1992-2011)	10-year records (2002-2011)
Brant	No responses	Occasional (n=2), Common (n=1)	1	0
Chatham-Kent	n=3	Rare (n=2)	1	1
Essex	n=7	Rare (n=3)	1	0
Haldimond-Norfolk	n=1 (near Long Point)	Occasional (n=2)	16	14
Huron	n=1 (portions)	Occasional (n=2), Frequent (n=1)	4	3
Lambton	n=4	Rare (n=2), Frequent (n=1)	7	3
Oxford	n=1 (portions)	Rare (n=1), Frequent (n=1)	1	1
Perth	n=1 (portions)	No responses	1	0
Waterloo	n=1 (northern portion)	Occasional (n=2), Common (n=1)	6	4

Fluctuations and Trends

There is not enough available data to discuss trends in population sizes at the regional or local scale. Professional opinions may provide some, albeit limited, insight. An informal survey of several prominent naturalists and herpetologists in 2002 found that most felt that the Eastern Milksnake was locally common at best, and that it had declined. Ten years later, the majority of respondents to the 2012 Milksnake Questionnaire could not provide comment on whether Eastern Milksnakes were experiencing a continuing decline either across their Canadian range, or within a particular region. One third of respondents (n=19, 36%) were of the opinion that Eastern Milksnakes are experiencing a continuing decline at the regional and/or national level. Of these, half (n=10) suggested a continuing decline is occurring specifically within southwestern Ontario (also see **Canadian Distribution**) and the Greater Toronto Area (across the region and/or within a particular jurisdiction therein). The overwhelming majority of respondents were not aware of any regions where the abundance or distribution of this species was presumed to have increased in the last 20 years.

In Quebec, some respondents to the 2012 Milksnake Questionnaire suggested population declines have occurred in heavily urbanized areas such as Montréal and Laval, which is quite likely considering the trend inferred in Toronto (see above) as well as the presence of similar threats (e.g., habitat loss, persecution and collection; see **Threats and Limiting Factors**). Others agree and also add that populations have likely been lost in the Montérégie region (Desroches pers. comm. 2013). Future declines might be expected in Quebec as both areas with the greatest number of Eastern Milksnake records (Gatineau and Montréal: Bider and Matte 1994) continue to be areas of urban expansion.

Only three respondents (6%) to the 2012 Milksnake Questionnaire said that Eastern Milksnakes are not experiencing a continuing decline across their Canadian range. Certainly, it is possible that presumed declines are simply an artifact of this species' low detection rate (see **Search Effort**). Nevertheless, most other large snakes in eastern Canada have declined and it is reasonable to suspect that Eastern Milksnakes have too, especially because they are as susceptible to roadkill, persecution and habitat loss (see **Threats and Limiting Factors**) as are other large snakes.

Rescue Effect

The relationship between Canadian and American populations of Eastern Milksnakes is currently unknown. It is possible that Eastern Milksnakes breed in areas where both nations are in close proximity and where Eastern Milksnakes are present on both sides of the border (e.g., Niagara peninsula, St. Lawrence Islands, Quebec-Vermont and Quebec-New York regions). The likelihood of such exchange is not known, but with a home range size of 5-29 ha (see **Habitat**) and the confirmed presence on certain Canadian islands in the latter regions, it is possible. Most U.S. states that are contiguous with Ontario and southern Quebec report secure populations of the Eastern Milksnake (Table 2), although certain bodies of water may present relatively impermeable barriers to reptile dispersal (e.g., the Niagara River: Yagi *et al.* 2009; Lake Erie and Lake Ontario). Such barriers may be less formidable or are non-existent between U.S. and Canadian populations in other regions such as southern Quebec and New York or Vermont.

It is assumed that immigrants from the U.S. would be adapted to survive in Canada as these would be native to either of the border regions from where they were immigrating and therefore adapted to the local climate. It is also assumed that there would be sufficient suitable habitat in at least a few of the border regions where Eastern Milksnakes occur on both sides of the border (e.g., southern Quebec).

The rescue effect is not likely to assist with the repopulation of Eastern Milksnakes in Ontario (southwestern Ontario and Toronto) due to limiting habitat and major dispersal barriers for immigrant snakes. Conversely, the lack of major barriers between U.S. populations and those in southern Quebec makes rescue from the U.S. a possibility.

THREATS AND LIMITING FACTORS

Threats are defined by the International Union for the Conservation of Nature (IUCN) as the "proximate human activities or processes that have impacted, are impacting, or may impact the status of the taxon being assessed" (IUCN 2013). Using the IUCN threats classification scheme (IUCN 2013), and considering only present and future threats, a threats assessment for the Eastern Milksnake in Canada was conducted in 2013 by 11 professionals in the herpetology, resource management or conservation fields (see **Appendix 3** and **Acknowledgements and Authorities Contacted** section). This exercise identified five threats to this species and all were in the 'medium' or 'low' threat impact category (five additional threats were identified with 'negligible' impacts, and will not be discussed). Following the standardized categories established by the IUCN (2013), these threats are: 1) Housing and urban areas, 2) Annual and perennial non-timber crops, 3) Roads and railroads, 4) Hunting and collecting of terrestrial animals, and 5) Invasive non-native/alien species. The timing of all threats was considered to be 'continuing'. It should be noted that in certain areas (e.g., urban landscapes of Toronto and Montréal), these threats likely act in concert to increase the extinction risk of local populations.

Based on the threats assessment, the severity, scope and overall impact level of each threat (IUCN 2013) is as follows:

1) Housing and urban areas: small in scope and serious in severity, with an overall threat impact level of 'low',
2) Annual and perennial non-timber crops: restricted in scope and serious-moderate in severity, with an overall threat impact level of 'medium – low',
3) Roads and railroads: large in scope and moderate in severity, with an overall threat impact level of 'medium',
4) Hunting and collecting of terrestrial animals: large in scope and slight in severity, with an overall threat impact level of 'low', and
5) Invasive non-native/alien species: restricted in scope and moderate in severity, with an overall threat impact level of 'low'.

Housing and Urban Areas

The expansion of urban areas and cultivated lands results in the direct loss of habitat and mortality of individual Eastern Milksnakes and contributes to local population declines. For example, Crowley's (2005) analysis suggested that lack of suitable habitat is a strong predictor of reptile extirpation events, and Lamond (1994) found a positive correlation between Eastern Milksnake observation records and percent forest cover in southern Ontario (see **Habitat Requirements**). Also, Mitchell (1994) proposed that habitat loss resulting from urbanization and deforestation in Pennsylvania was threatening the Eastern Milksnake with local extirpation. In Toronto, for example, decline in the number of localities (see **Canadian Range**) is presumed to be the result of habitat loss as natural areas were converted to intensive urban land. Similarly, although information on population trends is lacking for Quebec, we can presume habitat loss has likely resulted in a reduction in Eastern Milksnake population size or number of localities in the urban regions of Gatineau and Montréal (MDDEFPQ 2009; S. Pelletier pers. comm. 2013).

Annual and Perennial Non-timber Crops

The extensive modification of the landscape and loss of natural areas caused by intensive cultivation is presumed to have contributed to the rarity of Eastern Milksnakes and decline in localities in extreme southwestern Ontario (see **Canadian Range**). Brooks (2007) made a similar conclusion when referring to the decline in the Blue Racer (*Coluber constrictor foxii*): "A look at Essex, Kent and Lambton counties might suggest that a very dense network of roads, over 98% loss of natural habitat and lack of protected areas larger than a few hectares had something to do with loss of Blue Racer from mainland". In fact, the only Eastern Milksnake records from Essex, Lambton and Chatham-Kent (historical and contemporary) are from relatively large natural areas (e.g., Big Creek area near Amherstburg, Cedar Creek area, Point Pelee National Park, Rondeau Provincial Park, Walpole Island First Nation and the Lambton Shores area). Intensive agriculture practices are probably also having similar impacts on Eastern Milksnake populations in southern Quebec (MDDEFPQ 2009).

Interestingly, Eastern Milksnakes have often been associated with farming landscapes (i.e., barns, junk piles, outbuildings, abandoned fields). For example, in Toronto, all remnant populations of Eastern Milksnake have been found near old farm buildings or areas where farm buildings used to stand (Johnson 1989). Abundant rodent populations are found within active agricultural areas in rubbish heaps and in buildings (Vogt 1981). It may not be the conversion of the landscape for agriculture, *per se,* but rather the conversion to intensive forms of agriculture, such as those associated with cash crops (corn, soybeans). This would have resulted in larger scale crops, the loss of forest remnants or their reduction in size, the cultivation of vacant fields and the 'cleaning' up of abandoned farm buildings and junk piles that were of benefit to the Eastern Milksnake and their prey base (DeGraaf and Rudis 1983; Hunter *et al.* 1992; Cook pers. comm. 2002).

Roads and Railroads

Eastern Milksnakes are killed on roads across their Canadian range (Lamond 1994; Brunton 2008; Gunsen *et al.* 2009; Savanta Inc. 2010; AARQ 2012; ONHIC 2012). When systematic road mortality studies were conducted at a number of Canadian and U.S. localities, however, the number of Eastern Milksnakes found DOR relative to other snakes, is often extremely low (**Appendix 4**). In absolute terms, 7-11 Eastern Milksnakes have been recorded DOR per year at a few Canadian localities (**Appendix 4**). The impact of this level of mortality on a local population of Eastern Milksnakes is not entirely clear. Nonetheless, an analysis by Row *et al.* (2007) suggested that even a relatively low level of road mortality (~ 9 DOR per year across 10 km of roads) for a population (~400) of a rare long-lived snake (in their case, Gray Ratsnake) is sufficient to increase extinction risk to 99% in 500 years. Harding (1997) considers road mortality to be one of the greatest potential causes of milksnake decline and, at the very least, the levels observed at some Canadian sites are probably important stressors.

Hunting and Collecting of Terrestrial Animals

Like many other Canadian snakes, the Eastern Milksnake is often killed by people (Froom 1972). Its habit of mimicking the venomous Eastern Massasauga in both colouration and behaviour (e.g., tail vibration) leads some people to kill it out of fear or concern for safety. Persecution is probably an important stressor in populations that are in close proximity to dense settlements (Mitrovich *et al.* 2009), especially considering the species is known to frequent human habitations and enter basements.

Although persecuted by some, Eastern Milksnakes are desired as pets by others. This species is discussed and traded though online forums in Ontario and offers for sale range from $25.00 to $125.00 for an individual (V. Miller pers. comm. 2012). OMNR enforcement deals with approximately 7+ cases per year of the illegal sale of Eastern Milksnakes online and these are only the cases investigated on a complaint basis (Miller pers. comm. 2012). The majority of cases involve persons who collect and trade reptiles, some of which are captive-bred snakes, others involve wild-caught individuals mostly collected and offered for sale by youth (Miller pers. comm. 2012). Most cases are from southwestern Ontario and the Greater Toronto Area, with wild snakes being taken locally or from the cottage (Miller pers. comm. 2012).

The reptile pet trade in Canada is on the increase. In 2001 there was only one large reptile trade show per year held in Mississauga. Today, there are several shows held at larger venues in the Greater Toronto Area, Ottawa and Sudbury as well as in Alberta and Quebec. Although the interest in and size of Canadian reptile trade shows is small in comparison to many held in the U.S., they continue to grow (Miller pers. comm. 2012). At this time there are no statistics regarding illegal activities in Quebec; however, it has become evident that the reptile pet trade in Quebec is more popular than previously believed. The strain on indigenous species is not presently known by wildlife enforcement (Rioux pers. comm. 2012).

Based on their widespread distribution, and probably large total population size, it is not likely that the pet trade poses a significant threat to the persistence of many Eastern Milksnake populations in Canada. It is hard to image how a species that is so difficult to observe, even by professional herpetologists (see **Sampling Effort and Methods**), could become locally extirpated by over-collecting. Nonetheless, collecting wild snakes probably works in concert with other threats to increase the extinction risk of small populations in close proximity to developed areas (e.g., Hussey and Goulin 1990; NatureServe 2012).

Invasive Non-native/Alien Species

Pets, such as dogs and cats, that are associated with human-dominated landscapes also kill Eastern Milksnakes (Hussey and Goulin 1990). Large numbers of feral, barnyard and domestic cats would almost certainly have an impact on Eastern Milksnake populations around farms and residential areas (see Carbone and Gittleman 2002).

PROTECTION, STATUS, AND RANKS

Legal Protection and Status

The Eastern Milksnake is listed under Schedule 1 of the federal *Species at Risk Act* (SARA) as a species of Special Concern. One purpose of SARA is to manage species of Special Concern to prevent them from becoming Threatened or Endangered (EC 2012). Under SARA, the general prohibitions that protect species at risk from certain human activities (e.g., to kill, harm, harass, capture, take, possess, collect, buy, sell or trade) do not apply to species of Special Concern (EC 2008). A draft management plan for the Eastern Milksnake has been written (Crowley pers. comm. 2014).

Within National Parks, the Milksnake is afforded some protection under the *Canada National Parks Act*. Under this Act, it is forbidden to hunt, trap, kill, trade, or hold in captivity any specially protected species within a National Park without a permit (EC 2012). This species is also afforded some protection within National Wildlife Areas under the *Canada Wildlife Act* and within historic canals administered by Parks Canada under the *Department of Transport Act* (MOE 2004).

In Ontario, the Eastern Milksnake is listed as a species of 'Special Concern' under the *Ontario Endangered Species Act*. This species is also listed as a 'specially protected reptile' under Schedule 9 of the *Fish and Wildlife Conservation Act*, 1997. Under this Act, it is prohibited to hunt, trap, trade, or hold in captivity any specially protected reptile without a permit, with certain exceptions (in particular it is not prohibited to keep a single Eastern Milksnake in captivity for education purpose without a permit). The Eastern Milksnake is also protected in all provincial parks as well as in most conservation areas (Oldham pers. comm. 2002). In Quebec the Eastern Milksnake is listed as a 'species likely to be designated threatened or vulnerable' under the *Loi sur les espèces menacées ou vulnérables*. The species is also afforded protection under the *Loi sur la conservation et la mise en valeur de la faune* (RLRQ,c.C- 61.1) (act respecting the conservation and development of wildlife) (CQLR,c.C-61.1). Article 26 of this act states that "No person may disturb, destroy or damage the eggs, nest or den of an animal", and thus, the destruction of eggs as well as any hibernating sites of snakes is prohibited. The act prohibits the captivity or trade of wildlife without a permit. The Eastern Milksnake is not listed in the *Règlement sur les animaux en captivité* (RLRQ c. C-61.1, r. 5) (regulation respecting animals in captivity) (CQLR c. C-61.1, r. 5), so it is illegal to keep this species in captivity without a specific permit (Gauthier pers. comm. 2013).

Non-Legal Status and Ranks

In the United States, the Eastern Milksnake is neither listed under the U.S. *Endangered Species Act* nor is it a candidate for listing (USFWS 2012). The Eastern Milksnake has not yet been assessed for the IUCN Red List (IUCN 2012) and is not listed under the *Convention on International Trade in Endangered Species* (CITES) Appendices I, II or III (CITES 2011).

Globally, the Eastern Milksnake is ranked G5 (Secure). In Canada the Eastern Milksnake is ranked N3N4 (Vulnerable to apparently Secure) and at the provincial level (Ontario and Quebec), this species is ranked S3 (Vulnerable). The Ontario rank has changed from S4 (Apparently Secure) (Fischer 2002) to S3 (Vulnerable) (NatureServe 2012).

The Eastern Milksnake was assessed as a species of Special Concern by the Committee on the Status of Endangered Wildlife in Canada in 2002 (COSEWIC 2002). This species is also ranked as a 'Sensitive' species (category '3') at the national and provincial levels (Ontario and Quebec) by the Canadian Endangered Species Conservation Council (CESCC 2006). This category is reserved for species which are "not believed to be at risk of immediate extirpation or extinction but may require special attention or protection to prevent them from becoming at risk" (CESCC 2006). The General Status rank of this species was changed from "secure" in 2000 to "sensitive" in 2005 owing to the 2002 COSEWIC Status Report and improved knowledge of the species (CESCC 2006).

In the U.S., the milksnake is ranked N5 (Secure) and the state rankings of this species vary from S1 to S5. In Minnesota, the Eastern Milksnake is given special concern status by the Department of Natural Resources because of its high demand in the pet trade (Oldfield and Moriarty 1994).

Table 2. Conservation status ranks of the Eastern Milksnake (*Lampropeltis triangulum*) across its North American range (NatureServe 2012).

Rank	State/Province
S1 (Critically Imperiled)	Delaware, District of Columbia
S2 (Imperiled)	Alabama, Georgia,
S3 (Vulnerable)	New Jersey, South Carolina, Ontario, Quebec
S4 (Apparently Secure)	Illinois, Indiana, Kentucky, Minnesota, Wisconsin
S5 (Secure)	Connecticut, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New York, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, West Virginia
SNR (Unranked)	Missouri, Ohio, New Jersey
N3N4 (Vulnerable to Apparently secure	Canada
N5 (Secure)	United States
G5 (Secure)	Globally

Habitat Protection and Ownership

Eastern Milksnakes have been confirmed within at least 40 protected areas or other federally owned properties in Canada (**Appendix 5**). Combined, these provide at least 976 km^2 of habitat under some form of protection (not including Algonquin Park, see **Canadian Distribution**). This represents 3 - 67% of area occupied, depending on the estimate used (see **Extent of Occurrence and Area of Occupancy**). Eastern Milksnake habitat is also offered protection at many other Canadian sites owned by land trusts, non-governmental organizations, private lands with conservation easements, etc. (Giguère pers. comm. 2013). It is unknown if enough habitat is protected to ensure the long-term survival of the Eastern Milksnake in Canada. Because this is a species of Special Concern, critical habitat identification and protection are not required under SARA.

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Jonathan Choquette graduated with a B.Sc. in Biology (2007) and a Masters in Landscape Architecture (2011), both from the University of Guelph. His MLA thesis was focused on identifying habitat corridors for snakes in a fragmented landscape. He has conducted herpetofaunal surveys across the range of the Eastern Milksnake in southern and central Ontario and has contributed sightings to the Ontario Reptile and Amphibian Atlas. This is Jonathan's 3rd COSEWIC report; he co-authored the COSEWIC status report updates on Butler's Gartersnake in 2009 and the Eastern Massasauga Rattlesnake in 2011. His interests include urban herpetology, landscape ecology and conservation biology. His overarching goal is to combine his training in landscape architecture and biology to design landscapes where our herpetofauna populations are restored and reconnected.

INFORMATION SOURCES

Agriculture and Agri-Food Canada. 2012. Average Crop Heat Units Available for Corn and Soybean Production in Eastern Canada [Interactive Mapping Tool]. The National Land and Water Information Service. Web Site: http://nlwis1214snite1.agr.gc.ca/chu-utm/?lang=en-CA [accessed April 2012].

Allen, G. M. and M. J. Oldham. 1989. A Life Science Inventory and Evaluation of Cedar Creek, Essex County, Ontario: An Area of Natural and Scientific Interest (ANSI). Ontario Ministry of Natural Resources, southwestern region, Chatham, ON. 174 pp.

Applegate Reptiles. 2012. Breeding Milksnakes. Web Site: http://www.applegatereptiles.com/articles/bookbreeding.htm [accessed August 2012].

Ashley, E. P. and J. T. Robinson. 1996. Road mortality of amphibians, reptiles and other wildlife on the Long Point Causeway, Lake Erie, Ontario. The Canadian Field-Naturalist 110(3): 403-412.

Behler, J. 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. A.A. Knopf, Inc., New York, NY. 743 pp.

Bernadino, F. S. J. and G. H. Dalrymple. Seasonal activity and road mortality of the snakes of the Pa-Hay-Okee Wetlands of Everglades National Park, USA. Biological Conservation 62(1): 71-75.

Bider, R. J. and S. Matte. 1994. Atlas des Amphibiens et des Reptiles du Québec. Société d'histoire naturelle de la vallée du Saint-Laurent et Ministère de l'Environnement et de la Faune du Québec, Sainte-Anne-de-Bellevue, QC, et Québec, QC. 106 pp.

Bleakney, J. S. 1958. A Zoogeographical Study of the Amphibians and Reptiles of Eastern Canada. National Museum of Canada Bulletin, No. 155. 119 pp.

Blouin-Demers, G., pers. comm. 2013. *Email correspondence to James Bogart.* June 2013. Herpetologist, Univeristy of Ottawa, Ottawa, ON.

Blouin-Demers, G., P. J. Weatherhead and J. R. Row. 2004. Phenotypic consequences of nest-site selection in Black Rat Snakes (*Elaphe obsoleta*). Canadian Journal of Zoology 82(2004): 449–456.

Bowles, J. M. 2005. Draft Walpole Island Ecosystem Recovery Strategy. Prepared for Walpole Island Heritage Centre, Environment Canada and Walpole Island Recovery Team, Walpole Island. 50 pp.

Bowling Green State University Herpetology Lab (BGSU HL). 2012. *Lampropeltis triangulum triangulum* Eastern Milk Snake. Web Site: http://www.bgsu.edu/departments/biology/facilities/herp/caresheetpages/emilk.html [accessed August 2012].

Brooks, R. J., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Professor Emeritus, Department of Integrative Biology, University of Guelph, Guelph, ON.

Brooks, R. J. 2007. Chapter 10: Do reptiles in Canada have a future? An overview of the constraints on conserving Canadian snakes, turtles and lizards. Pp. 183-190. *in* C. N. L. Seburn and C. A. Bishop (eds.). Ecology, Conservation, and Status of Reptiles in Canada. Herpetological Conservation, No. 2. Society for the Study of Amphibians and Reptiles, Salt Lake City, UT.

Brooks, R. J., D. Strickland and R. J. Rutter. 2000. Reptiles and Amphibians of Algonquin Park. The Friends of Algonquin Park, Whitney, ON. 48 pp.

Brunton, D. F. 2008. Natural Environment Assessment (Existing Conditions): Ottawa River Interprovincial Crossing Corridors, Ottawa, Ontario/Gatineau, Quebec. Prepared by Brunton Consulting Services for Roche-NCE Ltd, Ottawa, ON, 147 pp.

Canada South Land Trust, (CSLT). 2011. Canada South Land Trust, Monitoring the Balkwill Lands. Web Site: http://www.canadasouthlandtrust.org [accessed April 2012].

Canadian Endangered Species Conservation Council (CESCC). 2006. Wild Species 2005: The General Status of Species in Canada. Available in French under Title: Espèces sauvages 2005 : La situation générale des espèces au Canada. Web Site: http://www.wildspecies.ca/wildspecies2005/index.cfm?lang=e [accessed February 2012].

Carbone, C. and J. L. Gittleman. 2002. A common rule for the scaling of carnivore density. Science 295: 2273-2276.

Carolinian Canada Coalition. 2011. Cedar Creek Conservation Area. Web Site: http://carolinian.org/CarolinianSites_CedarCreekCA.htm [accessed April 2012].

Centre de données sur le patrimoine naturel du Québec (CDPNQ). 2014. Database extraction for the Eastern Milksnake in Quebec. Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs, Québec.

Cochran, D. M. and C. J. Goin. 1970. The New Field Book of Reptiles and Amphibians. G.P. Putnam's Sons, New York, NY. 359 pp.

Coffin, B. and L. Pfannmuller. 1988. Minnesota's Endangered Flora and Fauna. University of Minnesota Press, Minneapolis, MN. 473 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. COSEWIC Assessment and Status Report on the Milksnake *Lampropeltis triangulum* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vi + 29 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2006. COSEWIC Assessment and Update Status Report on the Lake Erie Watersnake *Nerodia sipedon insularum* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 23 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007a. COSEWIC Assessment and Update Status Report on the Eastern Hog-Nosed Snake *Heterodon platirhinos* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. viii + 36 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2007b. COSEWIC Assessment and Update Status Report on the Gray Ratsnake *Elaphe spiloides* (Great Lakes/St. Lawrence Population and Carolinian Population) in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. vii + 33 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2009. COSEWIC Terrestrial Amphibian and Reptile Faunal Provinces. Web Site: http://www.cosewic.gc.ca/images/Fig3-FaunalProvinces_Eng.jpg [accessed April 2012].

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2012a. Status Reports: Definitions and Abbreviations. Committee on the Status of Endangered Wildlife in Canada. Web Site: http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm [accessed February 2014].

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2012b. In Press. COSEWIC Assessment and Status Report on the Massasauga *Sistrurus catenatus* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. xiii + 66 pp.

Conant, R. and J. T. Collins. 1991. A Field Guide to Reptiles and Amphibians of Eastern and Central North America, Third Edition. Houghton Mifflin Company, Boston, MA. 366 pp.

Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES). 2011. Appendices I, II and III. Web Site: http://www.cites.org/eng/app/appendices.php [accessed February 2012].

Cook, F. R. 1984. Introduction to Canadian Amphibians and Reptiles. National Museum of Natural Sciences, National Museums of Canada, Ottawa, ON. 200 pp.

Cook, F. R., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Curator of Herpetology (retired), Canadian Museum of Nature, Ottawa, ON.

Cook, F. R., pers. comm. 2012. *Email correspondence to Jonathan Choquette.* 2012. Curator of herpetology (retired), Canadian Museum of Nature, Ottawa, ON.

Crother, B. I. (*Ed.*). 2012. Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in Our Understanding, 7th Edition. Herpetological Circular No. 39. Society for Study of Amphibians and Reptiles, Salt Lake City, UT. 101 pp.

Crowley, J., pers. comm. 2014. *email correspondence to J. Choquette.* 2014. Herpetology Species at Risk Specialist, Ministry of Natural Resources, Peterborough, ON.

Crowley, J. F. 2005. Are Ontario Reptiles on the Road to Extinction? Anthropogenic Disturbance and Reptile Distributions within Ontario. M.Sc. dissertation, University of Guelph, Guelph, Ontario, Canada. 67 pp.

Degraaf, R. M. and D. D. Rudis. 1983. Amphibians and Reptiles of New England: Habitats and Natural History. University of Massachusetts Press, Amherst, MA. 85 pp.

Desroches, J.-F. 2003. Correctifs sur certaines mentions de l' atlas des amphibiens et des reptiles du Québec. Le Naturaliste Canadien 127(2): 67-70.

Desroches, J.-F. 2007. Correctifs sur certaines mentions de l' atlas des amphibiens et des reptiles du Québec - suite et fin. Le Naturaliste Canadien 131(2): 54-60.

Desroches, J.-F., pers. comm. 2013. *Email correspondence to Jonathan Choquette.* July 2013. Enseignant en Techniques de Bioécologie, Cégep de Sherbrooke, Sherbrooke, QC.

Ditmars, R. L. 1939. A Field Book of North American Snakes. Doubleday & Company, New York, NY. 305 pp.

Dodd, C. K. J., W. J. Barichivich and L. L. Smith. 2004. Effectiveness of a barrier wall and culverts in reducing wildlife mortality on a heavily traveled highway in Florida. Biological Conservation 118(1): 619-631.

Durso, A. M., J. D. Willson and C. T. Winne. 2011. Needles in haystacks: Estimating detection probability and occupancy of rare and cryptic snakes. Biological Conservation 144(2011): 1508-1515.

Dyrkacz, S. 1977. The natural history of the Eastern Milk Snake (Reptilia, Serpentes, Colubridae) in a disturbed environment. Journal of Herpetology 11(2): 155-159.

Enge, K. M. and K. N. Wood. 2002. A pedestrian road survey of an upland snake community in Florida. Southeastern Naturalist 1(4): 365-380.

Environment Canada (EC). 2008. Species at Risk Act: A Guide. Species at Risk Public Registry. Web Site: http://www.registrelep.gc.ca/archives/Guide_e.cfm#20 [accessed April 2012].

Environment Canada (EC). 2012. Species Profile: Milksnake. Species at Risk Public Registry. Web Site: http://www.registrelep.gc.ca/species/speciesDetails_e.cfm?sid=714 [accessed April 2012].

Ernst, C. H. and R. W. Barbour. 1989. Snakes of Eastern North America. George Mason University Press, Fairfax, Virginia. 282 pp.

Farmer, R. G. 2007. Factors Associated with Vertebrate Roadkill in Southern Ontario Parks. M.Sc. dissertation, University of Guelph, Guelph, Ontario, Canada. 147 pp.

Fischer, L. 2002. COSEWIC Status Report on the Milksnake *Lampropeltis triangulum* in Canada *in* COSEWIC Assessment and Status Report on the Milksnake *Lampropeltis triangulum* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 29 pp.

Fitch, H. S. and R. R. Fleet. 1970. Natural history of the Milk Snake (*Lampropeltis triangulum*) in northeastern Kansas. Herpetologica 26(1): 387-396.

Fortin, G., pers. comm. 2013. *Email correspondence to James Bogart.* June 2013. Canadian Wildlife Service, Quebec, QC.

Froom, B. 1972. The Snakes of Canada. McClelland and Stewart Limited, Toronto, ON. 128 pp.

Gaston, K. J. and R. A. Fuller. 2009. The sizes of species' geographic ranges. Journal of Applied Ecology 46(1): 1-9.

Gauthier, I., pers. comm. 2013. *Email correspondence to James Bogart.* June 2013. Ministère des Ressources Naturelles et de la Faune, Québec, QC.

Giguère, S., pers. comm. 2013. *Email correspondence to James Bogart.* June 2013. Canadian Wildlife Service, Quebec, QC.

Green, D. M., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Professor and Director, Redpath Museum, McGill University, Montréal, QC.

Green, N. B. and T. K. Pauley. 1987. Amphibians and Reptiles in West Virginia. University of Pittsburgh Press, Pittsburgh, PA. 241 pp.

Gunson, K. E., D. Ireland and F. Schueler. 2009. Incorporating road-mortality hotspot modeling and connectivity analyses into road mitigation planning in Ontario. Pp. 197 - 205, *in* P. J. Wagner, Debra Nelson and E. Murray (eds.). Proceedings of the 2009 International Conference of Ecology and Transportation, Duluth, Minnesota. Center for Transportation and the Environment, Institute for Transportation Research and Education, North Carolina State University, Raleigh, NC,

Harding, J. H. 1997. Amphibians and Reptiles of the Great Lakes Region. The University of Michigan Press, Ann Arbor, MI. 378 pp.

Hecnar, S. and D. Hecnar. 2004. Losses of amphibians and reptiles at Point Pelee National Park. Pp. 127-139, *in* Centre for Applied Science in Ontario Protected Areas (eds.). Proceedings of the Parks Research Forum of Ontario: Planning Northern Parks and Protected Areas, Lakehead University, Thunder Bay, ON. Centre for Applied Science in Ontario Protected Areas, Waterloo, ON.

Henderson, R. W., M. H. Binder, R. A. Sajdak, and J. A. Buday.1980. Aggregating behavior and exploitation of subterranean habitat by gravid eastern milksnakes (Lampropeltis t. triangulum). Milwaukee Public Museum Contributions in Biology and Geology 32: 1-9.

Hunter, M. L., J. Albright and J. Arbuckle. 1992. The Amphibians and Reptiles of Maine. Bulletin 838. Main Agricultural Experiment Station, 188 pp.

Hussey, R. and J. M. Goulin. 1990. Rattray Marsh Then and Now: Articles on the Human Settlement and Natural History of the Rattray Marsh Conservation Area. The Rattray Marsh Protection Association, Missisauga, ON. 210 pp.

International Union for the Conservation of Nature and Natural Resources (IUCN). 2012. The IUCN Red List of Threatened Species. Web Site: http://www.iucnredlist.org/apps/redlist/search [accessed February 2012].

International Union for the Conservation of Nature and Natural Resources (IUCN). 2013. The IUCN Red List of Threatened Species. Version 2013.2. Threats Classification Scheme (Version 3.2). Web Site: http://www.iucnredlist.org/technical-documents/classification-schemes/threats-classification-scheme [accessed Februiary 2014].

Jalava, J. V., W. L. Cooper and J. L. Riley. 2005. Ecological Survey of the Eastern Georgian Bay Coast. Nature Conservancy of Canada and Ontario Ministry of Natural Resources, Toronto, ON and Peterborough, ON. CD-ROM + 180 pp.

Johnson, B. 1982. Amphibians and Reptiles in Metropolitan Toronto - 1982 Inventory and Guide. Toronto Field Naturalists, Toronto, ON. 54 pp.

Johnson, B. 1989. Familiar Amphibians and Reptiles of Ontario. Natural Heritage Books, Toronto, ON. 168 pp.

Johnson, B., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Curator of Reptiles and Amphibians, Toronto Zoo, Toronto, ON.

Johnson, B., pers. comm. 2012. *Email correspondence to Jonathan Choquette.* April 2012. Curator of Reptiles and Amphibians, Toronto Zoo, Toronto, ON.

King, R. B., M.J. Oldham, W.F. Weller, and D. Wynn. 1997. Historic and current amphibian and reptile distributions in the Island Region of Western Lake Erie. American Midland Naturalist 138(1): 153-173.

Kjoss, V. A. and J. A. Litvaitis. 2001a. Community structure of snakes in a human-dominated landscape. Biological Conservation 98: 285-292.

Kjoss, V. A. and J. A. Litvaitis. 2001b. Comparison of 2 methods to sample snake communities in early successional habitats. Wildlife Society Bulletin 29(1): 153-157.

Lamond, W. G. 1994. The Reptiles and Amphibians of the Hamilton Area – an Historical Summary and the Results of the Hamilton Herpetofaunal Atlas. Hamilton Naturalists' Club, Hamilton, ON. 174 pp.

Langen, T. A., A. Machniak, E. K. Crowe, C. Mangen, D. F. Marker, N. Liddle and B. Roden. 2007. Methodologies for surveying herpetofauna mortality on rural highways. Journal of Wildlife Management 71(4): 1361-1368.

Lentini, A. M., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Curatorial keeper, Toronto Zoo, Toronto, ON.

Lentini, A. M., R. Lee and B. Johnson. 2011. Eastern Milk Snake Monitoring in Rouge Park, 2011 Report. Toronto Zoo, Toronto, ON. 15 pp.

Lindermeyer, D. and M. Burgman. 2005. Practical Conservation Biology. CSIRO Publishing, Collingwood, Victoria, Australia. 609 pp.

Logier, E. B. S. 1958. The Snakes of Ontario. University of Toronto Press, Toronto, ON. 94 pp.

Macculloch, R., pers. comm. 2002. *Personal correspondence to Lisa Fischer.* 2002. Assistant Curator, Herpetology, Royal Ontario Museum, Toronto, ON.

Mackinnon, C. A., L. A. Moore and R. J. Brooks. 2005. Why did the reptile cross the road? Landscape factors associated with road mortality of snakes and turtles in the South Eastern Georgian Bay Area. Pp. 153-166, *in* Centre for Applied Science in Ontario Protected Areas (eds.). Proceedings of the 2005 Ontario Parks Research Forum, University of Guelph, Guelph, ON. Centre for Applied Science in Ontario Protected Areas, Waterloo, Ontario.

Marks, S., pers. comm. 2011. *Personal correspondence to Jonathan Choquette.* 2011. Species at Risk Snake Specialist, Amec, Windsor, ON.

Mccauley Jr., R. H. 1945. The Reptiles of Maryland and the District of Columbia. Robert H. McCauley, Hagerstown, MD. 194 pp.

Miller, V., pers. comm. 2012. *Telephone and email correspondence to Jonathan Choquette.* 2012. Intelligence/ Investigation Specialist, Enforcement Branch, Ontario Ministry of Natural Resources, Peterborough, ON.

Ministère du développement durable, de l'environnement, de la faune et des parcs du Québec (MDDEFPQ). 2009. Liste des espèces fauniques menacées ou vulnérables au Québec: Couleuvre tachetée. Web Site: http://www.mddefp.gouv.qc.ca/faune/especes/menacees/fiche.asp?noEsp=82 [accessed July 2013].

Ministry of Environment (MOE). 2004. Government Response Statement for Milksnake. Web Site: http://www.sararegistry.gc.ca/document/default_e.cfm?documentID=339 [accessed April 2012].

Mitchell, J. C. 1994. The Reptiles of Virginia. Smithsonian Institution Press, Washington, DC. 368 pp.

Mitrovich, M. J., J. E. Diffendorfer and R. N. Fisher. 2009. Behavioural response of the coachwhip to habitat fragmentation and isolation in an urban landscape. Journal of Herpetology 43(3): 646-656.

Natural Resources Canada (NRC). 2009. The Atlas of Canada: National Parks. Web Site: http://atlas.nrcan.gc.ca/auth/english/learningresources/facts/parks.html [accessed August 2012].

Natureserve. 2012. Natureserve Explorer: An Online Encyclopedia of Life [Web Application]. Version 7.1. Web Site: http://www.natureserve.org/explorer [accessed July 2012].

Nernberg, D., pers. comm. 2012. *Email correspondence to Jonathan Choquette*. 2012. Species at Risk Officer, National Defence, Ottawa, ON.

New York State Department of Environmental Conservation. 2013. Eastern Milk Snake Distribution Map. New York State Amphibian and Reptile Atlas. Web Site: http://www.dec.ny.gov/animals/44648.html [accessed June 2013].

Oldfield, B. and J. J. Moriarty. 1994. Amphibians and Reptiles Native to Minnesota. University of Minnesota Press, Minneapolis, MN. 237 pp.

Oldham, M. J., pers. comm. 2002. *Personal correspondence to Lisa Fischer*. 2002. Botanist/Herpetologist, Ontario Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, ON.

Oldham, M. J. and D. A. Sutherland. 1986. 1984 Ontario Herpetofaunal Summary. Essex Region Conservation Authority, Essex, ON. 214 pp.

Ontario Ministry of Natural Resources (OMNR). 2008. Hullett Provincial Wildlife Area Wildlife Habitat Management Plan. Ontario Ministry of Natural Resources – Guelph District, Clinton, ON. 25 pp.

Ontario Ministry of Natural Resources (OMNR). 2012. Park Locator, Ontario Parks. Web Site: http://www.ontarioparks.com/english/locator.html [accessed April 2012].

Ontario Nature. 2013. Milksnake (*Lampropeltis triangulum*). Ontario Range Map. Web Site: http://www.ontarionature.org/protect/species/reptiles_and_amphibians/map_milksnake.html [accessed December 2013].

Patrick, D. A. and J. P. Gibbs. 2009. Snake occurrences in grassland associated with road versus forest edges. Journal of Herpetology 43(1): 716-720.

Patterson, J., pers. comm. 2012 and 2013. *Email correspondence to Jonathan Choquette*. 2012 and 2013. Ontario Reptile and Amphibian Atlas Coordinator, Ontario Nature, Toronto, ON.

Pelletier, S., pers. comm. 2013. *Email correspondence to Jonathan Choquette*. July 2013. Technicien de la faune, ministère du développement durable, de l' environnement, de la faune et des parcs du Québec, Québec, QC.

Pratt, P. 2010. Amphibians and Reptiles of the Ojibway Prairie Complex (Version Nov2010). Ojibway Nature Centre Home Page. Department of Parks & Recreation. Web Site: http://www.ojibway.ca/herps.htm [accessed February 2014].

Reed, G. and T. Mckenzie. 2009. Dyer's Bay, Northern Bruce Peninsula, Snake Roadkill Study 2009. Unpublished Report, 28 pp.

Rioux, J., pers. comm. 2012. *Telephone correspondence to Jonathan Choquette*. April 2012. Analyst, Wildlife Enforcement, Environment Canada, Montréal, QC.

Robson, L. E. 2011. The Spatial Ecology of Eastern Hognose Snakes (*Heterodon platirhinos*): Habitat Selection, Home Range Size, and the Effect of Roads on Movement Patterns. M.Sc. thesis, University of Ottawa, Ottawa, Ontario, Canada. 64 pp.

Row, J., pers. comm. 2012. *Email correspondence to Jonathan Choquette*. 2012. Postdoctoral Research Fellow, Department of Biology, Trent University, Peterborough, ON.

Row, J. R. and G. Blouin-Demers. 2006a. Thermal quality influences effectiveness of thermoregulation, habitat use, and behaviour in Milk Snakes. Oecologia 148(1): 1-11.

Row, J. R. and G. Blouin-Demers. 2006b. Kernals are not accurate estimators of home-range size for herpetofauna. Copeia 2006(4): 797-802.

Row, J. R., G. Blouin-Demers and P. Weatherhead. 2007. Demographic effects of road mortality in Black Ratsnakes (*Elaphe obsoleta*). Biological Conservation 137(2007): 117-124.

Ruane, S., R. W. Bryson, R. A. Pyron and F. T. Burbrink. 2014. Coalescent species delimitation in milksnakes (Genus *Lampropeltis*) and impacts on phylogenetic comparative analyses. Systematic Biology 63: 231-250.

Savanta Inc. 2010. Presqu'ile Bay Ecological Inventory Summary Report, 2009. Prepared for St. Mary's Cement Group, Brighton, ON, 13 pp.

Scallen, D., pers. comm. 2002. *Personal correspondence to Lisa Fischer*. 2002. Vice President, Halton- North Peel Naturalist Club, Georgetown, ON.

Scheffers, B., E. Mcdonald, D. J. Hocking, C. A. Conner and R. D. Semlitsch. 2009. Comparison of two artificial cover objects for sampling herpetofaunal communities in Missouri. Herpetological Review 40(4): 419-421.

Schueler, F. W. 1992. Herpetology of the Outer Bruce Peninsula, Volume II: Species Accounts. Prepared for Canadian Parks Service, Ontario Region, 5 pp.

Schueler, F. W., pers. comm. 2012. *Email correspondence to Jonathan Choquette*. 2012. Herpetologist, Bishops Mills Natural History Centre, Bishops Mills, ON.

Seburn, D. and C. Seburn. 2000. Conservation Priorities for the Amphibians and Reptiles of Canada. Prepared for World Wildlife Fund Canada and Canadian Amphibian and Reptile Conservation Network, Toronto, ON. 93 pp.

Shaffer, L. L. 1991. Pennsylvania Amphibians & Reptiles. Pennsylvania Fish Commission, Harrisburg, PA. 161 pp.

Smith, K. 2002. COSEWIC Status Report on the Eastern Ribbonsnake *Thamnophis sauritus* in Canada, *in* COSEWIC Assessment and Status Report on the Eastern Ribbonsnake *Thamnophis sauritus*. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 24 pp.

Smith, L. L. and C.K. Dodd Jr. 2003. Wildlife Mortality on U.S. Highway 441 across Paynes Prairie, Alucha County, Florida. Florida Scientist 66(2): 128-140.

Stewart, D. and D. Ross. 1977. Point Pelee – Canada's Deep South. Burns and MacEachern Ltd., Don Mills, ON. 112 pp.

Strickland, D. and R. J. Rutter. 1992. Reptiles and Amphibians of Algonquin Park. The Friends of Algonquin, Whitney, ON. 9 pp.

Tonge, M. 2006. Eastern Massasauga Monitoring and Protocol Development: 2006 Progress Report. Prepared for Bruce Peninsula National Park, Tobermory, ON. 101 pp.

Tyning, T. F. 1990. A Guide to Amphibians and Reptiles. Little, Brown and Company, Boston, MA. pp.

United States Fish and Wildlife Service (USFWS). 2012. U.S. Fish and Wildlife Service Endangered Species Program. Species Reports. Web Site: http://ecos.fws.gov/tess_public/SpeciesReport.do?groups=C&listingType=L&mapstatus=1 [accessed February 2012].

Vogt, R. C. 1981. Natural History of Amphibians and Reptiles in Wisconsin. The Milwaukee Public Museum, Milwaukee, WI. 205 pp.

Williams, K. L. 1988. Systematics and Natural History of the American Milk Snakes, *Lampropeltis triangulum*. Milwaukee Public Museum, Milwaukee, WI. 258 pp.

Williams, K. L. 1994. *Lampropeltis triangulum* (Lacepede) Milk Snake. Catalogue of American Amphibians and Reptiles 594(1): 1-10.

Willson, R. J., pers. comm. 2002. *Personal correspondence to Lisa Fischer* 2002. Director of Research, The Wilds of Pelee Island, Pelee Island, ON.

Willson, R. J. and J. D. Rouse. 2002. Update COSEWIC Status Report on the Blue Racer *Coluber constrictor foxii* in Canada, *in* COSEWIC Assessment and Update Status Report the Blue Racer *Coluber constrictor foxii* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 1-17 pp.

Yagi, A. R., A. Brant and R.Tervo. 2009. Niagara Region Natural Areas Inventory Reptile and Amphibian Study 2006 to 2008. Ontario Ministry of Natural Resources and Land Care Niagara, Vineland Station, ON. Appendices + 78 pp.

COLLECTIONS EXAMINED

Atlas des amphibiens et reptiles du Québec (AARQ). 2012. Atlas des amphibiens et reptiles du Québec : banque de données active depuis 1988 alimentée par des bénévoles et professionnels de la faune. Société d'histoire naturelle de la vallée du Saint-Laurent et ministère des ressources naturelles et de la faune du Québec.

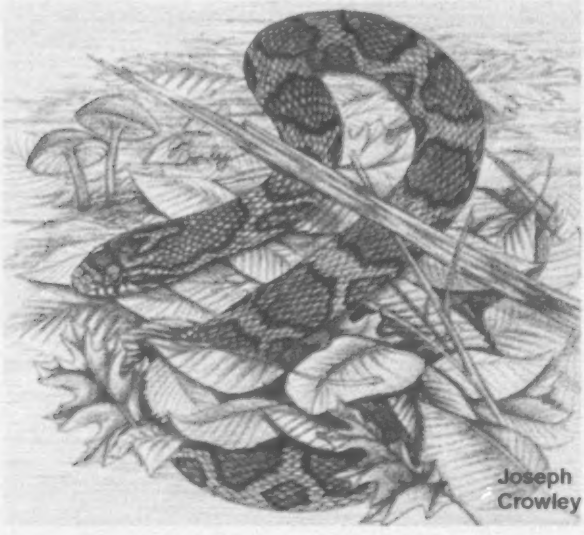
Canadian Museum of Nature. 2012. Catalogue of Milksnake, *Lampropeltis triangulum,* specimens in the Canadian Museum of Nature collection. Ottawa, ON.

Centre de données sur le patrimoine naturel du Québec (CDPNQ). 2014. Extractions du système de données pour le couleuvre tachetée dans le territoire de Québec. Le ministère des ressources naturelles et de la faune. Québec, QC.

Ontario Natural Heritage Information Centre (ONHIC). 2012. Milk Snake – Ontario Herpetofaunal Summery (OHS) database. Ontario Natural Heritage Information Centre, Peterborough, ON.

Appendix 1. Questionnaire that was mailed out by Jonathan Choquette (report writer) to 184 naturalists, herpetologists, resource managers, consultants, and others in Ontario and Quebec who were presumed to have experience with or possess knowledge of Milksnakes in Canada.

COSEWIC STATUS REPORT UPDATE ON THE EASTERN MILKSNAKE (*Lampropeltis triangulum*) IN CANADA - 2012 QUESTIONNAIRE –



Prepared by Jonathan Choquette
February 2012

Dear Colleagues

Thank you for contributing to our knowledge on the status of the Eastern Milksnake in Canada. Your information, opinions and insights provided through this questionnaire will be of tremendous value to the COSEWIC Status Report update.

Instructions:

- Please fill out the questionnaire in as much detail as you can. If you can only provide partial answers to some of the questions, that is OK. If you cannot answer all the questions, that's OK too. Please submit your questionnaire even it is only partially completed.

- This questionnaire will take approximately 30 minutes of your time, but you are free to invest more or less time if you wish.
- Please fill it out digitally[1], using Microsoft Word (or similar)
- Answer the 'Yes/No' questions by inserting an 'X' within the appropriate '( )'
- Save your completed questionnaire using the following naming format and file type:
    - QUESTIONNAIRE_COSEWIC_MISN_[your first initial].[your last name])
    - .doc, .docx or .pdf

Please submit your questionnaire to Jonathan Choquette by April 8, 2012.

As a token of my appreciation, all those who complete and return the questionnaire by the deadline will be entered into a draw for a $50.00 gift certificate to Future Shop and a Limited Edition wildlife print from an Ontario artist! *(fill out the entry form at the end of the questionnaire)*

Feel free to forward any questions about the survey or the status report update to: Jonathan Choquette

Thank You Very Much!

2012 COSEWIC MILKSNAKE QUESTIONNAIRE

Demographics

1. Please provide your name and contact information:
    a. Name:
    b. Affiliation (employer, institution, naturalist club, independent, etc.):
    c. Telephone:
    d. Email:

2. Are you proficient at identifying the Snakes on Ontario and Quebec?
    a. Yes( ), No( ), Somewhat( )

3. Are you able to accurately distinguish Milksnakes from similar species?
    a. Yes( ), No( ), Somewhat ( ), Don't Know ( )

[1] If you would like to arrange for an alternate form of responding to the questionnaire - hard copy or by phone - please do not hesitate to contact me.

4. Which region(s) in Ontario or Quebec are you MOST familiar with in terms of reptile distribution, abundance, or habitat? For example, where you have conducted the most searches, where you work, etc. (Region in Ontario = county, regional municipality, district, or tertiary watershed; Region in Quebec = comté, municipalité locale).
    a. [*Insert answer*]

Observation Records

5. In which region (s) have you encountered a wild Milksnake in Canada?
    a. Regions: [*Insert answer*]
    b. Don't Know / Don't remember ( )
    c. I Have encounterd a wild Milksnake ( )

6. Do you have any personal observation records of Milksnakes in Canada that **HAVE NOT** been submitted to a provincial atlas or data gathering project (e.g., NHIC, OHS, ORAA, and AARQ[2])?
    a. Yes ( ), No ( )

7. Do you have any personal observation records of Milksnakes in Canada that **HAVE BEEN** submitted to a provincial atlas or data gathering project within the last 2 years (2010-2012)?
    a. Yes ( ), No ( )

8. If you answered YES to either of Q6 or Q7, are you willing and able to share these records for the purposes of the COSEWIC status report update?
    a. Yes ( ), No ( )

    If YES, Thank You. Please include them when you submit your completed questionnaire (in an Excel sheet if possible[3])

Distribution

9. In which category would you place the Milksnake, based on your experience with this species in one or more regions?

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[2] NHIC= Ontario Natural Heritage Information Centre (http://nhic.mnr.gov.on.ca/)
OHS = Ontario Herpetofaunal Summary Atlas (http://nhic.mnr.gov.on.ca/herps/ohs.html)
ORAA = Ontario Reptile and Amphibian Atlas Project (http://www.ontarionature.org/protect/species/atlas_FAQ.php)
AARQ= Atlas des Amphibiens et Reptiles du Québec (http://www.atlasamphibiensreptiles.qc.ca/)

[3] Ontario Nature provides a useful spreadsheet for reporting records:
http://www.ontarionature.org/protect/docs/ORAA_Reporting_Sheet_Oct%2011_2011.xls.

Category of distribution	Region: *[insert region(s) in the corresponding row below]*
Widespread	
Highly localized	
Don't Know ( )	
Other: *[specify]*	

10. If you know the approximate number of Milksnake locations[4] in any of the regions listed in the previous question, please indicate:
    a. [*insert region and # of locations*] [*insert region and # of locations*], etc.
    b. Don't Know ( )

11. Within the Canadian range of the Milksnake, are you aware of any extensive areas or portions of regions where they appear to be absent?
    a. Yes( ), No( ), Don't Know ( )

    If yes, please describe these areas, mention if any reptile surveys were conducted, and provide any other relevant details:

    _____

Abundance

12. Where Milksnakes are present locally, how would you rate their apparent abundance (on average) relative to other snake species?

Category of abundance (from least -1- to most - 5 - abundant)	Region: *[insert region(s) in the corresponding row below]*
1 - Rare	
2 - Occasional	
3 - Frequent	
4 - Common	
5 - Abundant	
Don't Know ( )	

13. Are you aware of any studies that have estimated population size or capture rate[5] of local Milksnake populations in Canada?
    a. Yes( ) , No( )

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[4] A location, as defined by the IUCN, is a geographically or ecologically distinct area. It may contain all or part of a subpopulation of the taxon, and is typically a small proportion of the taxon's total distribution. A single threatening event, based on the most serious plausible threat, can rapidly affect all individuals of the species present.

[5] Capture rates are calculated as the number of Milksnakes found per person per hour of searching or the proportion of Milksnakes encountered out of all snakes encountered.

If Yes, please provide a reference or appropriate contact person (with contact info.): _____

Fluctuations and Trends

14. In your professional opinion, are there any regions in Canada where Milksnakes are experiencing a continuing decline[6] (based on study, anecdote, personal observations, etc.)?
    a. Yes( ) : [*insert Region(s)*],
    b. No( ), Don't Know ( )

    Please provide any relevant details to support your answer:

    _____

15. In your professional opinion, are Milksnakes experiencing a continuing decline across their Canadian range?
    a. Yes( ), No( ), Don't Know ( )

    Please provide any relevant details to support your answer:

    _____

16. Are you aware of any regions where local abundance or distribution of Milksnakes was observed or is presumed to have INCREASED[7] in the last 20 years (based on study, anecdote, personal observations, etc.)?
    a. Yes( ): [*insert Region(s)*],
    b. No( ), Don't Know ( )

    If yes, please provide any relevant details to support your answer:

    _____

Habitat Trends

17. Do you know of any regions where individuals of this taxon are found in small and relatively isolated populations (i.e., severely fragmented populations)?
    a. Yes( ): [*insert Region(s)*],
    b. No( ), Don't Know ( )

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[6] A continuing decline, as defined by the IUCN, is a recent, current or projected future decline whose causes are not known or not adequately controlled and so is liable to continue unless remedial measures are taken. Natural fluctuations will not normally count as a continuing decline.

[7] An increase may refer to either a range expansion, an increase in population size or the discovery of previously undocumented populations or Milksnake locations.

That concludes the questionnaire. Thank you for your time and information, it will provide a tremendous help in understanding the current status of this cryptic species in Canada. Please don't forget to attach an Excel sheet of your Milksnake records, if relevant.

➔ Excel Sheet attached: Yes ( ), No ( )

If you wish to share any additional comments relevant to the status of the Milksnake in Canada, please include them in the space below:

_____

Would you like to be entered into a draw for one (1) of two (2) prizes: 1) $50.00 gift certificate to Future Shop, 2) Limited edition wildlife print from Russ Jones?

- No ( ), that's ok, let someone else win
- Yes ( ), I would like to be entered in the draw
    - Name:_____
    - Phone: _____
    - Email: _____

Two (2) winners to be selected by random draw from a hat on Monday, April 9, 2012.

Appendix 2. A selection of snake surveys conducted across the North American range of the Milksnake.

Study Author(s)	Locality	Survey Method (s)	# of Field Seasons	Total # of snakes observed	Total # of Milksnakes observed	% Milksnake observations
J. Choquette and D. Noble unpub. data.	Luther Marsh and vicinity, Wellington County, ON	Opportunistic surveys and cover boards	1	148	1	1%
Enge and Wood (2002)	Hernando County, Florida	Road surveys and drift fences	4	634	14	2%
D.M. Green pers. comm. 2002	Mont Saint-Hilaire region, QC	"intensive annual surveys"	Unk.	Unk.	Unk.	"Milksnake is one of the least often encountered species"
Kjoss and Litvaitis (2001b)	New Hampshire	Drift fences and black plastic cover sheets	2	500	8	2%
Lentini *et al.* (2011)	Rouge Park, Toronto, ON	Cover boards and opportunistic surveys	1	71	11	15%
Patrick and Gibbs (2009)	Cicero Swamp, New York	Cover boards and opportunistic surveys	1	1400	15	1%
Scheffers *et al.* (2009)	Missouri	Wood and carpet cover objects	2	102	6	6%

Appendix 3. Threats classification and assessment calculator for the Eastern Milksnake (*Lampropeltis triangulum*) in Canada completed November 5, 2013.

THREATS ASSESSMENT WORKSHEET

Species or Ecosystem Scientific Name	Eastern Milksnake *(Lampropeltis triangulum)*
Element ID	**Elcode**
Date (Ctrl + ";" for today's date):	05/11/2013
Assessor(s):	Jim Bogart, Dave Fraser, Jonathan Choquette (Author), Vivian Brownell (Ontario), Gabriel Blouin-Demers (SSC member), Scott Gillingwater (SSC member), Jeff Row (Ontario zoo), Isabelle Gauthier (QC), Daniel Pouliot (QC), Yohann Dubois (QC), Simon Pelletier (QC)
References:	

Overall Threat Impact Calculation Help:

		Level 1 Threat Impact Counts	
Threat Impact		**high range**	**low range**
A	Very High	0	0
B	High	0	0
C	Medium	2	1
D	Low	3	4
Calculated Overall Threat Impact:		**High**	**High**

Assigned Overall Threat Impact:	
Impact Adjustment Reasons:	
Overall Threat Comments	

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1	Residential & commercial development	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	
1.1	Housing & urban areas	D	Low	Small (1-10%)	Serious (31-70%)	High (Continuing)	More of a threat in southern Ontario and Montréal. In Quebec, urban zone (1006km^2)accounts for 4% of total distribution (25,968km^2), so a scope of 'small' is appropriate (these numbers were derived from data from the Ministère des affaires municipales et des régions du Quebec.
1.2	Commercial & industrial areas		Negligible	Negligible (<1%)	Moderate (11-30%)	High (Continuing)	More of a threat in southern Ontario and Montréal

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
1.3	Tourism & recreation areas		Negligible	Negligible (<1%)	Unknown	Unknown	
2	Agriculture & aquaculture	CD	Medium - Low	Restricted (11-30%)	Serious - Moderate (11-70%)	High (Continuing)	
2.1	Annual & perennial non-timber crops	CD	Medium - Low	Restricted (11-30%)	Serious - Moderate (11-70%)	High (Continuing)	Intensification of agriculture lands due to conversion of wetlands and removal of windbreaks and field edges (conversion to corn and soy fields). Need more information on the rate of intensification of agriculture.
2.2	Wood & pulp plantations						
2.3	Livestock farming & ranching						
2.4	Marine & freshwater aquaculture						
3	Energy production & mining		Negligible	Negligible (<1%)	Serious (31-70%)	Low (Possibly in the long term, >10 yrs)	
3.1	Oil & gas drilling						
3.2	Mining & quarrying		Negligible	Negligible (<1%)		Low (Possibly in the long term, >10 yrs)	
3.3	Renewable energy						
4	Transportation & service corridors	C	Medium	Large (31-70%)	Moderate (11-30%)	High (Continuing)	
4.1	Roads & railroads	C	Medium	Large (31-70%)	Moderate (11-30%)	High (Continuing)	
4.2	Utility & service lines						
4.3	Shipping lanes						
4.4	Flight paths						
5	Biological resource use	D	Low	Large (31-70%)	Slight (1-10%)	High (Continuing)	
5.1	Hunting & collecting terrestrial animals	D	Low	Large (31-70%)	Slight (1-10%)	High (Continuing)	Report writer says that based on a random survey, 3% of general population admitted that they would kill snakes should they encounter one. This was not included in status report because survey is unpublished.
5.2	Gathering terrestrial plants						
5.3	Logging & wood harvesting						
5.4	Fishing & harvesting aquatic resources						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
6	Human intrusions & disturbance		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	
6.1	Recreational activities		Negligible	Restricted (11-30%)	Negligible (<1%)	High (Continuing)	
6.2	War, civil unrest & military exercises						
6.3	Work & other activities						
7	Natural system modifications						
7.1	Fire & fire suppression						
7.2	Dams & water management/use						
7.3	Other ecosystem modifications						
8	Invasive & other problematic species & genes	D	Low	Restricted (11-30%)	Moderate (11-30%)	High (Continuing)	
8.1	Invasive non-native/alien species	D	Low	Restricted (11-30%)	Moderate (11-30%)	High (Continuing)	
8.2	Problematic native species		Negligible	Large (31-70%)	Negligible (<1%)	High (Continuing)	
8.3	Introduced genetic material						
9	Pollution						
9.1	Household sewage & urban waste water						
9.2	Industrial & military effluents						
9.3	Agricultural & forestry effluents						
9.4	Garbage & solid waste						
9.5	Air-borne pollutants						
9.6	Excess energy						
10	Geological events						
10.1	Volcanoes						
10.2	Earthquakes/tsunamis						
10.3	Avalanches/landslides						
11	Climate change & severe weather						

Threat		Impact (calculated)		Scope (next 10 Yrs)	Severity (10 Yrs or 3 Gen.)	Timing	Comments
11.1	Habitat shifting & alteration						
11.2	Droughts						
11.3	Temperature extremes						
11.4	Storms & flooding						

Classification of Threats adopted from IUCN-CMP, Salafsky *et al.* (2008).

Appendix 4. A selection of road mortality surveys conducted across the North American range of the Milksnake.

Study	# of Years of Data Collection (Incidental and/or systematic)	Locality (kilometres of road surveyed)	# Milksnakes recorded dead-on-road (DOR)	Proportion of total snake DOR that were Milksnakes
Ashley and Robinson 1996	4 (1979-1980, 1992-1993)	Long Point, ON (4km)	1	1% (1/148)
Bernadino and Dalrymple 1992	5 (1986-1989)	Everglades National Park, Florida (12km)	1	<1% (1/1172)
Enge and Wood 2002	4 (1998-2001)	Hernando County, Florida. (6km)	9	4% (9/213)
Farmer 2007	1 (2005)	Point Pelee National Park and Rondeau Provincial Park (? km)	0 (presence is questionable)	0% (0/263)
Langen *et al.* 2007	1 (2002)	St. Lawrence County, New York (350+km)	0 (present in the local area)	0% (0/12)
Lentini *et al.* 2011	30 (1982-2012)	Rouge Park area, Toronto ON (? km)	~ 9 yearly	Unk.
Mackinnon *et al.* 2005	2 (2003-04)	Muskoka District, ON (13km)	15	6% (15/269)
OREG 2012 (as cited by Lentini *et al.* 2011)	2 (2010-11)	Rouge Park area, Toronto ON (? km)	23	Unk.
Reed and McKenzie 2010	1 (2009)	Northern Bruce Peninsula, ON (20km)	9	4% (10/270)
Smith and Dodd 2003, Dodd *et al.* 2004	3 (1998-1999, 2001)	Paynes Prairie, Florida (3km)	1	<1% (1/772)
Tonge 2006	1 (2006)	Upper Bruce Peninsula, ON (1110km)	7	5% (7/146)

Appendix 5. List of Canadian protected areas (national, provincial and regional parks, conservation areas and provincial nature reserves) and other federal lands (e.g., Department of National Defence lands, First Nations) where the Eastern Milksnake (*Lampropeltis triangulum*) has been recorded (Fischer [2002] made reference to the OHS and the Centre de données sur la patrimoine naturel du Québec for determining Milksnake presence). This table does not include properties owned by land trusts, non-governmental organizations, private lands with conservation easements, or other areas with some degree of protection.

Jurisdiction (County/Regional Municipality)	Protected Area/First Nation	Size (ha)	Source (observation, locality size)
Bruce, ON	Cyprus Lake Provincial Park	?	Fischer 2002
	Georgian Bay Islands National Park (including Fathom Five National Marine Park)	2560	Fischer 2002, NRC 2009
	Inverhuron Provincial Park	288	Fischer 2002, OMNR 2012
	MacGregor Point Provincial Park	1204	Fischer 2002, OMNR 2012
Dufferin, ON	Monocliffs Provincial Park		Fischer 2002
Essex, ON	Holiday Beach Conservation Area (Historical location)	?	Fischer 2002
	Point Pelee National Park	1550	Fischer 2002, NRC 2009
	Cedar Creek Conservation Area (Historical location)	524	Allen and Oldham 1989, Carolinian Canada Coalition 2011
Frontenac, ON	Dead Creek Conservation Area	?	Fischer 2002
	Canadian Forces Base Kingston	?	D. Nernberg pers. comm. 2012
Grey, ON	Craigleith Provincial Park	66	Fischer 2002, OMNR 2012
	Canadian Forces Training Centre Meaford	?	D. Nernberg pers. comm. 2012
Halton, ON	Bronte Creek Provincial Park	640	Fischer 2002, OMNR 2012
Haldimand-Norfolk, ON	Long Point Provincial Park	150	Fischer 2002, OMNR 2012
	Selkirk Provincial Park	73	Fischer 2002, OMNR 2012
Hamilton-Wentworth, ON	Berry Conservation Area	?	Fischer 2002
Huron, ON	Hullet Provincial Wildlife Area	2200	OMNR 2008
Kent, ON	Rondeau Provincial Park	3254	Fischer 2002, OMNR 2012
Leeds and Grenville, ON	Charleston Lake Provincial Park	2353	Fischer 2002, OMNR 2012
	St. Lawrence Islands National Park	870	Fischer 2002, NRC 2009
	Browns Bay Provincial Park	?	Fischer 2002
Lambton, ON	Chippewas of Kettle and Stony Point First Nation (Previously Ipperwash Provincial Park)	?	Fischer 2002
	The Pinery Provincial Park Walpole Island First Nation	2532?	Fischer 2002, OMNR 2012, Bowles 2005
Lanark, ON	Murphy's Point Provincial Park	1239	Fischer 2002, OMNR 2012
Muskoka, ON	The Massasauga Provincial Park – O'Donnell Point Provincial Nature Reserve	13105	Fischer 2002, Jalava *et al.* 2005
	McDonald Bay Park Reserve	?	Fischer 2002
	Six Mile Lake Provincial Park	94	Fischer 2002, OMNR 2012
	Gibson River Nature Reserve	?	Fischer 2002

Jurisdiction (County/Regional Municipality)	Protected Area/First Nation	Size (ha)	Source (observation, locality size)
Niagara, ON	Effingham Provincial Park	?	Fischer 2002
	Rockway Conservation Area	?	Fischer 2002
Nipissing, ON	Algonquin Provincial Park	765345	Fischer 2002, OMNR 2012
	Mattawa Wild River Provincial Park	?	Fischer 2002
Northumberland, ON	Alderville First Nation	?	EC 2012
	Presqu'ile Provincial Park	937	Savanta 2010, OMNR 2012
Parry Sound, ON	Grundy Lake Provincial Park	2554	Fischer 2002, OMNR 2012
	Blackstone Harbour Provincial Park	?	Fischer 2002
Peel, ON	Forks of the Credit Provincial Park	?	Fischer 2002
Peterborough, ON	Petroglyphs Provincial Park	1643	Fischer 2002, OMNR 2012
Prince Edward, ON	Sandbanks Provincial Park	1509	Fischer 2002, OMNR 2012
	Outlet Beach Provincial Park	?	Fischer 2002
	Prince Edward Point National Wildlife Area	?	Fischer 2002
	Canadian Forces 8 Wing Trenton - Point Petre Transmitter Site	?	D. Nernberg pers. comm. 2012
Renfrew, ON	Canadian Forces Base Petawawa	?	D. Nernberg pers. comm. 2012
Simcoe, ON	Awenda Provincial Park	2915	Fischer 2002, OMNR 2012
	Matchadash Bay Provincial Wildlife Area	?	www.tinymarsh.on.ca
	Tiny Marsh Provincial Wildlife Area	?	www.tinymarsh.on.ca
	Canadian Forces Base Borden	?	D. Nernberg pers. comm. 2012
Sudbury, ON	Killarney Provincial Park	49325	Fischer 2002, OMNR 2012
Gatineau, QC	Parc de la Gatineau	?	Fischer 2002
Montréal, QC	Parc-nature du Cap-Saint- Jacques	?	Fischer 2002
	Parc-nature du Bois-de-l'Île-Bizard	216	S. Giguère pers. comm. 2013